

## QUESTION 8.



7 (a) (i)

Accumulator: 

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 |
|---|---|---|---|---|---|---|---|

 [1]

(ii)

Accumulator: 

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |
|---|---|---|---|---|---|---|---|

 [1]

**explanation**

- content of 124 is 0 1 1 1 1 1 1 1
- this is equivalent to 127
- contents of 127 are 0 1 1 0 1 0 0 1

[2]

(iii)

Accumulator: 

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
|---|---|---|---|---|---|---|---|

 [1]

**explanation**

- index register value = 6
- $120 + 6 = 126$
- contents of 126 placed in the accumulator

[2]



(b) 1 mark for each correct value in the table.

| Accumulator | Memory address |     |     |     |
|-------------|----------------|-----|-----|-----|
|             | 320            | 321 | 322 | 323 |
|             | 49             | 36  | 0   | 0   |
| 36          |                |     |     |     |
| 37          |                |     |     |     |
|             |                |     |     | 37  |
| 49          |                |     |     |     |
| 50          |                |     |     |     |
|             |                |     | 50  |     |

[6]

## QUESTION 9.



9 (a) (i) **One mark** for the contents of the accumulator and **one mark** for the reason. [2]

Accumulator contents: 0100 0101

Reason:

Address is 60

Contents of the index register is 8

And  $60 + 8 = 68$  in denary gives the address

The contents of which is 0100 0101 in binary.

(ii) **0000 0111** [1]



(b)

| Instruction address | Working space | ACC | Memory address |     |     |     | IX | C   |
|---------------------|---------------|-----|----------------|-----|-----|-----|----|-----|
|                     |               |     | 100            | 101 | 102 | 103 |    |     |
|                     |               |     | 20             | 100 | 1   | 0   | 1  |     |
| 50                  |               | 20  |                |     |     |     |    |     |
| 51                  |               | 21  |                |     |     |     |    |     |
| 52                  |               |     |                |     |     | 21  |    |     |
| 53                  |               | 100 |                |     |     |     |    |     |
| 54                  |               | 120 |                |     |     |     |    |     |
| 55                  |               |     |                |     |     |     |    |     |
| 56                  |               |     |                |     |     |     |    |     |
| 57                  |               |     |                |     |     |     |    |     |
| 59                  |               |     |                |     |     |     | 2  |     |
| 60                  |               | 20  |                |     |     |     |    |     |
| 61                  |               | 120 |                |     |     |     |    |     |
| 62                  |               |     |                |     |     |     |    | 'x' |
| 63                  |               |     |                |     |     |     |    |     |

One mark for each shaded block.

[7]

- Contents of the Accumulator in first 2 lines (instruction addresses 50 and 51)
- Updating address 103 (instruction 52)
- Loading the Accumulator and addition (instructions 53 and 54)
- Not executing instruction 58
- Incrementing the index register (instruction 59)
- Loading the Accumulator and addition (instructions 60 and 61)
- Correct output of 'x' (instruction 62)

## QUESTION 10.

4 (a) 11001110

(b)

| Instruction | Working space | ACC | Memory address |    |    |    | IX | OUTPUT |
|-------------|---------------|-----|----------------|----|----|----|----|--------|
|             |               |     | 90             | 91 | 92 | 93 |    |        |
|             |               |     | 2              | 90 | 55 | 34 | 2  |        |
| 20          |               | 55  |                |    |    |    |    |        |
| 21          |               | 54  |                |    |    |    |    |        |
| 22          |               |     | 54             |    |    |    |    |        |
| 23          |               |     |                |    |    |    | 3  |        |
| 24          |               | 34  |                |    |    |    |    |        |
| 25          |               | 33  |                |    |    |    |    |        |
| 26          |               |     |                |    |    |    |    |        |
| 27          |               |     |                |    |    |    |    |        |
| 28          |               |     |                |    |    |    |    |        |
| 31          |               | 67  |                |    |    |    |    |        |
| 32          |               |     |                |    |    | 67 |    |        |
| 33          |               |     |                |    |    |    |    | 'C'    |
| 34          |               |     |                |    |    |    |    |        |

**One mark** each for:

- Instruction 20
- Instructions 21 and 22
- Instruction 23
- Instructions 24 and 25
- Not executing instructions 29 and 30
- Instructions 31 and 32
- Correct output



## QUESTION 11.



8 (a) (i)

|              |   |   |   |   |   |   |   |   |
|--------------|---|---|---|---|---|---|---|---|
| Accumulator: | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |
|--------------|---|---|---|---|---|---|---|---|

[1]

(ii) **One mark** for answer and **two marks** for explanation

|              |   |   |   |   |   |   |   |   |
|--------------|---|---|---|---|---|---|---|---|
| Accumulator: | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
|--------------|---|---|---|---|---|---|---|---|

- Index Register contains  $1001 = 9$
- $800 + 9 = 809$

[3]

(b) (i) **ONE** mark for each correct row.

| ACC | Memory address |     |     |     | OUTPUT |
|-----|----------------|-----|-----|-----|--------|
|     | 800            | 801 | 802 | 803 |        |
|     | 40             | 50  | 0   | 90  |        |
| 40  |                |     |     |     |        |
| 90  |                |     | 90  |     |        |
| 90  |                |     | 90  |     |        |
|     |                |     |     |     | Z      |
|     |                |     |     |     |        |

[4]

(ii) 107

[1]



(c) (i) Any **two** from:

- Only 128 / 256 characters can be represented
- Uses values 0 to 127 (or 255 if extended form) / one byte
- Many characters used in other languages cannot be represented
- In extended ASCII the characters from 128 to 255 may be coded differently in different systems

[2]

(ii) Any **two** from:

- Uses 16, 24 or 32 bits / two, three or four bytes
- Unicode is designed to be a superset of ASCII
- Designed so that most characters (in other languages) can be represented

[2]

## QUESTION 12.

Cambridge International AS/A Level – October/November 2016



5 (a) (i)

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 |
|---|---|---|---|---|---|---|---|

(ii) **ONE** mark for Accumulator contents, **ONE** mark for the explanation.

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
|---|---|---|---|---|---|---|---|

- Index Register holds the value 4;  $101 + 4 = 105$  so load data from address 105

[2]

(iii) **ONE** mark for Accumulator contents, **TWO** marks for the explanation.

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 |
|---|---|---|---|---|---|---|---|

- Memory address 103 contains the value 107
- So address 107 is the address from which to load the data

[3]

(b) **ONE** mark for each correct row.

| ACC | Memory address |     |     |     |
|-----|----------------|-----|-----|-----|
|     | 810            | 811 | 812 | 813 |
|     | 28             | 41  | 0   | 0   |
| 28  |                |     |     |     |
| 29  |                |     |     |     |
|     |                |     | 29  |     |
| 41  |                |     |     |     |
| 70  |                |     |     |     |
|     |                |     |     | 70  |

[6]

## QUESTION 13.



|          |                                                                                                                                                                       |                               |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| 4(a)(iv) | 80                                                                                                                                                                    | 1                             |
| 4(b)     | <div> <div>00000001</div> <div>00010001</div> <div>00001100</div> <div>01100001</div> </div> <p>Both correct op codes<br/>Operand 0001 0001<br/>Operand 0110 0001</p> | <p>3</p> <p>1<br/>1<br/>1</p> |
| 4(c)     | 256                                                                                                                                                                   | 1                             |
| 4(d)(i)  | <p>07 C2</p> <p>07<br/>C2</p>                                                                                                                                         | <p>2</p> <p>1<br/>1</p>       |
| 4(d)(ii) | <p>LDI 63</p> <p>LDI<br/>63</p>                                                                                                                                       | <p>2</p> <p>1<br/>1</p>       |



| Question     | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |              |   |   |   |   |   |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---|---|---|---|---|--|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5(a)(i)      | <ul style="list-style-type: none"><li>Count the number of one bits in the <u>first seven</u> bit positions</li><li>Add a 0 or 1 to bit position 0, to make the count of one bits an <u>odd</u> number</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |   |   |   |   |   |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 5(a)(ii)     | A = 1<br>B = 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |   |   |   |   |   |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 5(a)(iii)    | <p><b>Two</b> from:</p> <ul style="list-style-type: none"><li>A parity bit is worked out for each <u>column</u> 1</li><li>The computer checks the parity of each bit position in parity byte // the computer generates copy of the parity byte and <u>compares</u> 1</li><li>If incorrect parity then there is an error in the data received // No parity error means no error in the data received 1</li><li>The position of the incorrect bit can be determined 1</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                              | 2            |   |   |   |   |   |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 5(b)(i)      | <table><tr><th colspan="8">Bit position</th></tr><tr><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td></tr></table> | Bit position |   |   |   |   |   |  |  | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| Bit position |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |   |   |   |   |   |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 7            | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 5            | 4 | 3 | 2 | 1 | 0 |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1            | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0            | 0 | 1 | 1 | 0 | 0 |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0            | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1            | 0 | 0 | 0 | 0 | 0 |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0            | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1            | 1 | 0 | 1 | 0 | 1 |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1            | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1            | 1 | 0 | 0 | 0 | 1 |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1            | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0            | 0 | 0 | 0 | 1 | 0 |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0            | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1            | 0 | 0 | 1 | 0 | 0 |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0            | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0            | 0 | 0 | 0 | 0 | 1 |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0            | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0            | 1 | 1 | 0 | 0 | 0 |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 5(b)(ii)     | <p><b>Three</b> from:</p> <ul style="list-style-type: none"><li>Consider each row in sequence 1</li><li>Identify any row with incorrect parity 1</li><li>Repeat the process for each column in sequence 1</li><li>Identify where a row and column with incorrect parity intersect 1</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3            |   |   |   |   |   |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |



| Question  | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |          |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 6(a)      | <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Main memory management</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Input/Output Management</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Secondary storage Management</div> <div style="border: 1px solid black; padding: 5px;">Human computer interface</div> </div> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">The user moves the mouse on the desktop</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">The user closes the Spreadsheet program</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">The user selects the Save command to save their spreadsheet file</div> <div style="border: 1px solid black; padding: 5px;">The user selects the Print command to output their spreadsheet file</div> </div> </div> <p><b>One</b> mark for each correct line from each left hand box <b>to max <u>three</u></b> marks.</p> |          |
| 6(b)(i)   | File compression software                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>1</b> |
| 6(b)(ii)  | Backup software                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>1</b> |
| 6(b)(iii) | Disk repair software                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>1</b> |
| 6(b)(iv)  | Anti-virus software                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>1</b> |



| Question  | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |              |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 7(a)      | <p><b>Two</b> from:</p> <ul style="list-style-type: none"> <li>The user's web browser is the client software 1</li> <li>The requested web page has program code / script embedded <u>within it</u> 1</li> <li>This code is interpreted by the web browser 1</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |              |
| 7(b)      | <p><b>Four</b> from:</p> <ul style="list-style-type: none"> <li>The browser parses the URL to obtain the Domain Name 1</li> <li>The browser software passes the Domain Name to the nearest Domain Name Server (DNS) 1</li> <li>The DNS stores a list of Domain Names and matching IP addresses 1</li> <li>The DNS Name Resolver looks for the Domain Name in its database 1</li> <li>If found the corresponding IP address is returned to the originator 1</li> <li>If not found the request is forwarded to another higher level DNS 1</li> <li>The original DNS adds the returned IP address to its cache 1</li> <li>The original DNS returns the IP address to the originator 1</li> <li>The browser uses the IP address to request the required web page from the <u>web server</u> 1</li> <li>The web server retrieves the page and delivers it to the originator 1</li> <li>The browser software interprets <u>the script</u> and displays the web page 1</li> </ul> | <b>Max 4</b> |
| 7(c)(i)   | <p>Message1, Message2 1</p> <p>x 1</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>2</b>     |
| 7(c)(ii)  | 6 – 19                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>1</b>     |
| 7(c)(iii) | 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>1</b>     |
| 7(c)(iv)  | Checks that the product code has not be left blank // presence check on product code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>1</b>     |
| 7(c)(v)   | <p><b>Two</b> checks from:</p> <p><b>One</b> mark for check and <b>one</b> mark for description</p> <ul style="list-style-type: none"> <li>Range check 1</li> <li>Check the number entered is (say) between 1 and 100 1</li> <li>Format check 1</li> <li>Checks the product code is a particular format // Checks the number has digit characters only // by example 1</li> <li>Length check 1</li> <li>The number of items has exactly five characters 1</li> <li>Existence check 1</li> <li>To ensure the product code has been assigned 1</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Max 4</b> |

# QUESTION 14.



| Question  | Answer | Marks |
|-----------|--------|-------|
| 5(a)(i)   | 351    | 1     |
| 5(a)(ii)  | 355    | 1     |
| 5(a)(iii) | 22     | 1     |



| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |         |    |     |    |     |   |         |   |         |   |   |   |   |  |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|----|-----|----|-----|---|---------|---|---------|---|---|---|---|--|--|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|
| 5(a)(iv) | 86                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         |    |     |    |     |   |         |   |         |   |   |   |   |  |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |
| 5(b)     | <table><thead><tr><th colspan="8">Op code</th><th colspan="8">Operand</th></tr></thead><tbody><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr></tbody></table> <p>Both correct op codes 1<br/>Operand 0100 0011 1<br/>Operand 0000 0111 1</p> | Op code |    |     |    |     |   |         |   | Operand |   |   |   |   |  |  |  | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |  |
| Op code  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |    |     |    |     |   | Operand |   |         |   |   |   |   |  |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |
| 0        | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0       | 1  | 0   | 0  | 1   | 0 | 0       | 1 | 0       | 0 | 0 | 1 | 1 |  |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |
| 0        | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0       | 1  | 0   | 1  | 0   | 1 | 0       | 0 | 0       | 0 | 1 | 1 | 1 |  |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |
| 5(c)(i)  | <table><tbody><tr><td>14</td><td>5E</td><td></td></tr><tr><td>14</td><td></td><td>1</td></tr><tr><td>5E</td><td></td><td>1</td></tr></tbody></table>                                                                                                                                                                                                                                                                                                                                                                        | 14      | 5E |     | 14 |     | 1 | 5E      |   | 1       | 2 |   |   |   |  |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |
| 14       | 5E                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         |    |     |    |     |   |         |   |         |   |   |   |   |  |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |
| 14       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1       |    |     |    |     |   |         |   |         |   |   |   |   |  |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |
| 5E       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1       |    |     |    |     |   |         |   |         |   |   |   |   |  |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |
| 5(c)(ii) | <table><tbody><tr><td>LDR #77</td><td></td></tr><tr><td>LDR</td><td>1</td></tr><tr><td>#77</td><td>1</td></tr></tbody></table>                                                                                                                                                                                                                                                                                                                                                                                              | LDR #77 |    | LDR | 1  | #77 | 1 | 2       |   |         |   |   |   |   |  |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |
| LDR #77  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |    |     |    |     |   |         |   |         |   |   |   |   |  |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |
| LDR      | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |         |    |     |    |     |   |         |   |         |   |   |   |   |  |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |
| #77      | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |         |    |     |    |     |   |         |   |         |   |   |   |   |  |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |

# QUESTION 15.

Cambridge  
International  
AS & A Level

**Cambridge Assessment International Education**  
Cambridge International Advanced Subsidiary and Advanced Level



---

**COMPUTER SCIENCE**

**9608/11**

Paper 1 Written Paper

**October/November 2017**

MARK SCHEME

Maximum Mark: 75

---

**Published**

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2017 series for most Cambridge IGCSE<sup>®</sup>, Cambridge International A and AS Level components and some Cambridge O Level components.

---

© IGCSE is a registered trademark.

This document consists of **7** printed pages.



**Cambridge Assessment**  
International Education



| Question  | Answer                                                                                                              |   |   |   |   |   |   |   |   |  |
|-----------|---------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|--|
| 1(a)(i)   | 119                                                                                                                 |   |   |   |   |   |   |   |   |  |
| 1(a)(ii)  | −120                                                                                                                |   |   |   |   |   |   |   |   |  |
| 1(a)(iii) | <table border="1"><tr><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 |  |
| 1         | 1                                                                                                                   | 1 | 0 | 1 | 1 | 1 | 1 |   |   |  |
| 1(a)(iv)  | Lowest value: −128<br>Highest value: +127                                                                           | 1 |   |   |   |   |   |   |   |  |
| 1(b)(i)   | 0110 0101 0011                                                                                                      | 1 |   |   |   |   |   |   |   |  |
| 1(b)(ii)  | The second block of four binary digits represents a digit larger than 9 // 14                                       | 1 |   |   |   |   |   |   |   |  |
| 1(b)(iii) | A string of digits on any electronic device displaying numeric values                                               | 1 |   |   |   |   |   |   |   |  |

| Question | Answer                                                                                                                                                                                                                                                 | Marks |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 2(a)     |                                                                                                                                                                                                                                                        | 4     |
| 2(b)(i)  | <b>One mark from:</b> <ul style="list-style-type: none"> <li>The program code can be translated to run on any processor / platform</li> <li>Source code is translated into machine independent intermediate code not machine dependent code</li> </ul> | 1     |



| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                    |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2(b)(ii) | <p><b>Two marks</b> from:</p> <ul style="list-style-type: none"> <li>• Java uses a two-step translation process</li> <li>• Java code is partially interpreted – partially compiled</li> <li>• Code is translated first into intermediate code / "bytecode"...</li> <li>• ...using the Java compiler</li> <li>• The bytecode is finally interpreted by the Java Virtual Machine</li> </ul> |

| Question     | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Marks        |        |            |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |  |  |  |        |          |  |  |  |  |        |              |  |  |  |            |          |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------|------------|---|----|---|---|---|---|----|---|---|---|---|----|---|---|---|---|----|---|---|---|---|---|---|---|---|---|---|--|--|--|--------|----------|--|--|--|--|--------|--------------|--|--|--|------------|----------|
| 3(a)         | <p><b>Two marks</b> from:</p> <ul style="list-style-type: none"><li>Physical measures</li><li>Access rights</li><li>Encryption</li><li>Firewall</li><li>Use authentication methods such as usernames and passwords</li><li>Anti-malware program</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Max 2</b> |        |            |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |  |  |  |        |          |  |  |  |  |        |              |  |  |  |            |          |
| 3(b)(i)      | <table border="1"><tr><td>7</td><td>X</td><td>6</td><td>=</td><td>42</td></tr><tr><td>8</td><td>X</td><td>5</td><td>=</td><td>40</td></tr><tr><td>6</td><td>X</td><td>4</td><td>=</td><td>24</td></tr><tr><td>5</td><td>X</td><td>3</td><td>=</td><td>15</td></tr><tr><td>3</td><td>X</td><td>2</td><td>=</td><td>6</td></tr><tr><td>1</td><td>X</td><td>1</td><td>=</td><td>1</td></tr><tr><td></td><td></td><td></td><td>Total:</td><td>128 / 11</td></tr><tr><td></td><td></td><td></td><td></td><td>11 R 7</td></tr><tr><td colspan="4">Check digit:</td><td>11 – 7 = 4</td></tr></table> <p>1 mark for 6 values</p> <p>1 mark for 2 steps<br/>Accept 128 MOD 11 = 7</p> <p>1 mark for subtraction</p> <p>Answer: 786531 4 (1 mark for answer)</p> | 7            | X      | 6          | = | 42 | 8 | X | 5 | = | 40 | 6 | X | 4 | = | 24 | 5 | X | 3 | = | 15 | 3 | X | 2 | = | 6 | 1 | X | 1 | = | 1 |  |  |  | Total: | 128 / 11 |  |  |  |  | 11 R 7 | Check digit: |  |  |  | 11 – 7 = 4 | <b>4</b> |
| 7            | X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 6            | =      | 42         |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |  |  |  |        |          |  |  |  |  |        |              |  |  |  |            |          |
| 8            | X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 5            | =      | 40         |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |  |  |  |        |          |  |  |  |  |        |              |  |  |  |            |          |
| 6            | X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4            | =      | 24         |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |  |  |  |        |          |  |  |  |  |        |              |  |  |  |            |          |
| 5            | X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3            | =      | 15         |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |  |  |  |        |          |  |  |  |  |        |              |  |  |  |            |          |
| 3            | X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2            | =      | 6          |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |  |  |  |        |          |  |  |  |  |        |              |  |  |  |            |          |
| 1            | X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1            | =      | 1          |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |  |  |  |        |          |  |  |  |  |        |              |  |  |  |            |          |
|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              | Total: | 128 / 11   |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |  |  |  |        |          |  |  |  |  |        |              |  |  |  |            |          |
|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |        | 11 R 7     |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |  |  |  |        |          |  |  |  |  |        |              |  |  |  |            |          |
| Check digit: |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |        | 11 – 7 = 4 |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |  |  |  |        |          |  |  |  |  |        |              |  |  |  |            |          |
| 3(b)(ii)     | <p><b>One mark</b> for name of check<br/><b>One mark</b> for description<br/><b>Max two</b> checks</p> <p>Uniqueness check<br/>Each PatientID must be unique</p> <p>Length check<br/>Each PatientID is exactly 7 characters</p> <p>Format check / Type check<br/>All 7 characters must be <u>digits</u></p> <p>Presence check<br/>PatientID must be entered</p>                                                                                                                                                                                                                                                                                                                                                                                        | <b>Max 4</b> |        |            |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |  |  |  |        |          |  |  |  |  |        |              |  |  |  |            |          |



| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |           |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |    |  |   |   |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------|--------|--|----|--|----|--|---|----|--|--|----|----|--|----|--|---|----|--|--|----|----|--|----|--|--|----|--|---|---|
| 4(a)     | A – System clock<br>B – Control unit<br>C – Main memory<br>E – Control bus<br>F – Data bus                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |           |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |    |  |   |   |
| 4(b)     | <table border="1"> <thead> <tr> <th>ACC</th><th>CountDown</th><th>OUTPUT</th></tr> </thead> <tbody> <tr> <td></td><td>15</td><td></td></tr> <tr> <td>67</td><td></td><td>C</td></tr> <tr> <td>15</td><td></td><td></td></tr> <tr> <td>14</td><td>14</td><td></td></tr> <tr> <td>51</td><td></td><td>3</td></tr> <tr> <td>14</td><td></td><td></td></tr> <tr> <td>13</td><td>13</td><td></td></tr> <tr> <td>32</td><td></td><td></td></tr> <tr> <td>88</td><td></td><td>x</td></tr> </tbody> </table> <p>(1)<br/>(1) + (1)<br/>(1)<br/>(1)</p>    | ACC    | CountDown | OUTPUT |  | 15 |  | 67 |  | C | 15 |  |  | 14 | 14 |  | 51 |  | 3 | 14 |  |  | 13 | 13 |  | 32 |  |  | 88 |  | x | 5 |
| ACC      | CountDown                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | OUTPUT |           |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |    |  |   |   |
|          | 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |           |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |    |  |   |   |
| 67       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | C      |           |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |    |  |   |   |
| 15       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |           |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |    |  |   |   |
| 14       | 14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |           |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |    |  |   |   |
| 51       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3      |           |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |    |  |   |   |
| 14       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |           |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |    |  |   |   |
| 13       | 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |           |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |    |  |   |   |
| 32       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |           |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |    |  |   |   |
| 88       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | x      |           |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |    |  |   |   |
| 4(c)     | <b>Three marks from:</b> <ul style="list-style-type: none"> <li>The assembler scans the assembly language instructions in sequence</li> <li>When it meets a symbolic address checks to see if already in symbol table</li> <li>If not, it adds it to the symbol table in the symbolic address column</li> <li>If it is already in symbol table check if absolute address known</li> <li>If the absolute address is known, it is entered in the appropriate cell</li> <li>If the absolute address is not known mark / leave as unknown</li> </ul> | Max 3  |           |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |    |  |   |   |
| 4(d)(i)  | The op code / mnemonic / instruction table                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1      |           |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |    |  |   |   |
| 4(d)(ii) | <b>A – 1110 0110 0110 1000</b><br>(1)                   (1)<br><br><b>B – E6 68</b> (1)                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3      |           |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |    |  |   |   |



| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 5(a)(i)  | <b>Three marks</b> from: <ul style="list-style-type: none"> <li>• Diaphragm / cone</li> <li>• (Voice) coil of wire</li> <li>• Spider / Suspension</li> <li>• (Permanent) Magnet</li> <li>• Basket</li> <li>• Dust cap</li> <li>• Outer frame</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |              |
| 5(a)(ii) | <b>Four marks</b> from: <ul style="list-style-type: none"> <li>• Takes an electrical signal and translates it into physical vibrations to create sound waves</li> <li>• An electric current in the coil creates an electro-magnetic field</li> <li>• Changes in the audio signal causes the direction of the electric current to change</li> <li>• The direction of the current determines the polarity of the electro-magnet // changing the direction of the current changes the direction of the polarity of the electro-magnet</li> <li>• The electro-magnet is repelled by or attracted to the permanent magnet</li> <li>• Causing the coil to vibrate</li> <li>• The movement of the coil causes the cone / diaphragm to vibrate</li> <li>• That vibration is transmitted to the air in front of the cone / diaphragm as sound waves</li> <li>• The amount of movement will determine the frequency and amplitude of the sound wave produced</li> </ul> | <b>Max 4</b> |
| 5(b)(i)  | <b>One mark</b> from: <ul style="list-style-type: none"> <li>• External hard disk drive // SSD</li> <li>• External CD / DVD drive</li> <li>• Pen drive</li> <li>• Blu-ray drive</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>1</b>     |
| 5(b)(ii) | <b>Two marks</b> from: <ul style="list-style-type: none"> <li>• Additional secondary file storage // storing files</li> <li>• Backup of files</li> <li>• Archiving of files</li> <li>• Transfer files to second computer</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Max 2</b> |



| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 6(a)     | <b>Two marks</b> from: <ul style="list-style-type: none"> <li>• A system of moral principles</li> <li>• That guide behaviour / decision making</li> <li>• Based on philosophical / religious views</li> <li>• By example, e.g. respectful and considerate behaviour</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                    |              |
| 6(b)     | <b>One mark</b> for identifying the issue<br><b>One mark</b> for correct principle<br><b>One mark</b> for possible action<br><b>Max 2</b> issues (2 × 3 marks)<br><br>1 Uncomfortable with one of his colleagues<br>Client and Employer // Management / Colleagues // Judgement // Self<br>For example: Team building exercises // arranged meeting<br><br>2 Unfamiliar with programming language<br>Self // Client and Employer // Product // Profession // Colleagues<br>For example: Undergo training<br><br>3 Visit to unfamiliar workplace<br>Client and employer // Management // Judgement // Profession // Colleagues<br>For example: He should speak to his manager to discuss situation | <b>Max 6</b> |

| Question | Answer                                                                                                                                                                                                                                                                                                                               | Marks    |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 7(a)(i)  | <u>PatientID</u> }<br><u>DoctorID</u> } (1)<br><br><u>AppointmentDate, AppointmentTime</u> (1)                                                                                                                                                                                                                                       | <b>2</b> |
| 7(a)(ii) | <pre> graph TD     PATIENT &lt;--&gt; DOCTOR     PATIENT --&gt; APPOINTMENT     DOCTOR --&gt; APPOINTMENT           </pre><br>One PATIENT attends many APPOINTMENTs<br>One DOCTOR takes many APPOINTMENTs<br><br>Special case for 1 mark only (only if no one to many relationships shown)<br>Many PATIENTs are seen by many DOCTORs | <b>2</b> |



| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                           |              |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 7(b)     | <b>Two marks</b> from:<br>Either: <ul style="list-style-type: none"> <li>Add an attribute (for example <code>Attended</code> )</li> <li>To the appointment table // <code>APPOINTMENT</code></li> </ul> Or: <ul style="list-style-type: none"> <li>Add an attribute (for example <code>AppointmentsMissed</code> )</li> <li>To the patient table // <code>PATIENT</code></li> </ul>                                                                              |              |
| 7(c)(i)  | Available to work at both <code>SITE-A</code> and <code>SITE-B</code>                                                                                                                                                                                                                                                                                                                                                                                            | <b>1</b>     |
| 7(c)(ii) | <code>APPOINTMENT(Site, AppointmentDate, AppointmentTime, DoctorID, PatientID)</code>                                                                                                                                                                                                                                                                                                                                                                            | <b>1</b>     |
| 7(d)(i)  | <b>One mark</b> per line<br><br><code>UPDATE DOCTOR</code><br><code>SET DoctorID = '017'</code><br><code>WHERE DoctorID = '117';</code>                                                                                                                                                                                                                                                                                                                          | <b>3</b>     |
| 7(d)(ii) | <b>1 Mark</b> per bullet, max 2 <ul style="list-style-type: none"> <li>Referential integrity should be maintained // Referential integrity could be violated.</li> <li>Data becomes inconsistent</li> <li>There may be records in the <code>APPOINTMENT</code> table showing doctor ID 117</li> <li>The <code>APPOINTMENT</code> table might not be automatically updated</li> <li>Records in the <code>APPOINTMENT</code> table will become orphaned</li> </ul> | <b>Max 2</b> |
| 7(e)     | <b>One mark</b> per line<br><br><code>SELECT AppointmentDate, AppointmentTime</code><br><code>FROM APPOINTMENT</code><br><code>WHERE PatientID = '556';</code>                                                                                                                                                                                                                                                                                                   | <b>3</b>     |

## QUESTION 16.



| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |          |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 4(a)     | <b>1 Mark</b> for each correct answer<br>A – General purpose registers<br>B – System clock<br>C – ALU<br>E – Control bus<br>F – Address bus                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |          |
| 4(b)     | <b>1 Mark</b> per bullet, max 2 <ul style="list-style-type: none"> <li>The clock sends out a number of pulses in a given time interval (clock speed)</li> <li>Each processor instruction takes a certain number of clock cycles to execute</li> <li>The higher the clock frequency, the shorter the execution time for the instruction<br/>// Increasing the clock frequency improves performance</li> </ul>                                                                                                                                                                                                                                                                                                                                                                       | <b>2</b> |
| 4(c)(i)  | <b>1 Mark</b> per bullet<br>Maximum 2 for Macro<br>Maximum 2 for Directive<br>Maximum 3 in total<br><br><b>Macro</b> <ul style="list-style-type: none"> <li>A group of instructions given a name // subroutine</li> <li>A group of instructions that need to be executed several times within the same program</li> <li>The statements are written once and called using the name whenever they need to be executed</li> <li>Macro code is inserted into the source file at each place it is called</li> <li>By example</li> </ul> <b>Directive</b> <ul style="list-style-type: none"> <li>An instruction that directs the assembler to do something</li> <li>A directive is not a program instruction</li> <li>It is information for the assembler</li> <li>By example</li> </ul> | <b>3</b> |
| 4(c)(ii) | <b>1 Mark</b> for a suitable example<br><br>For example: State the start address for the program //tell the assembler to set aside space for variables // include an external file etc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>1</b> |



| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |        |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |  |  |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------|--------|--|----|--|----|--|---|----|--|--|----|----|--|----|--|--|--|--|---|----|--|--|----|----|--|----|--|---|----|--|--|----|----|--|----|--|--|
| 4(d)     | <div>Mark as shown</div> <table><thead><tr><th>ACC</th><th>Offset</th><th>OUTPUT</th></tr></thead><tbody><tr><td></td><td>10</td><td></td></tr><tr><td>50</td><td></td><td>2</td></tr><tr><td>10</td><td></td><td></td></tr><tr><td>11</td><td>11</td><td></td></tr><tr><td>65</td><td></td><td></td></tr><tr><td></td><td></td><td>A</td></tr><tr><td>11</td><td></td><td></td></tr><tr><td>12</td><td>12</td><td></td></tr><tr><td>89</td><td></td><td>Y</td></tr><tr><td>12</td><td></td><td></td></tr><tr><td>13</td><td>13</td><td></td></tr><tr><td>32</td><td></td><td></td></tr></tbody></table> <div><p>1 Mark for these two values, as first instructions</p><p>1 Mark for this value, in any row</p><p>1 Mark for this value, in any row</p><p>1 Mark for this value, after 65, nothing in between</p><p>1 Mark for the rest</p></div> | ACC    | Offset | OUTPUT |  | 10 |  | 50 |  | 2 | 10 |  |  | 11 | 11 |  | 65 |  |  |  |  | A | 11 |  |  | 12 | 12 |  | 89 |  | Y | 12 |  |  | 13 | 13 |  | 32 |  |  |
| ACC      | Offset                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | OUTPUT |        |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |  |  |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |
|          | 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |        |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |  |  |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |
| 50       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2      |        |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |  |  |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |
| 10       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |        |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |  |  |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |
| 11       | 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |        |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |  |  |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |
| 65       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |        |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |  |  |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |
|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | A      |        |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |  |  |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |
| 11       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |        |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |  |  |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |
| 12       | 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |        |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |  |  |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |
| 89       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Y      |        |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |  |  |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |
| 12       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |        |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |  |  |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |
| 13       | 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |        |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |  |  |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |
| 32       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |        |        |  |    |  |    |  |   |    |  |  |    |    |  |    |  |  |  |  |   |    |  |  |    |    |  |    |  |   |    |  |  |    |    |  |    |  |  |



| Question           | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                  |                  |   |        |                  |       |                       |                    |                      |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------|------------------|---|--------|------------------|-------|-----------------------|--------------------|----------------------|
| 4(e)               | <p>Mark as follows:</p> <p><b>Table entries:</b><br/> <b>1 Mark</b> per bullet, max 4</p> <ul style="list-style-type: none"> <li>• EndProg</li> <li>• 2 × Unknown</li> <li>• 9</li> <li>• 14</li> <li>• 8</li> </ul> <p><b>Numbering:</b><br/> <b>1 Mark</b> per bullet, max 2</p> <ul style="list-style-type: none"> <li>• Relative address of Value is numbered 6</li> <li>• Number given for EndProg is next number in sequence to relative address of Value</li> <li>• All numbers correct – award 2 marks</li> </ul> <table border="1"> <thead> <tr> <th>Symbolic address</th><th>Relative address</th></tr> </thead> <tbody> <tr> <td><u>StartProg</u></td><td>0</td></tr> <tr> <td>Offset</td><td>           UNKNOWN<br/>           9 (1)         </td></tr> <tr> <td>Value</td><td>           UNKNOWN (6)<br/>           14 (1)         </td></tr> <tr> <td><u>EndProg</u> (7)</td><td>           UNKNOWN (8)<br/>           8 (9)         </td></tr> </tbody> </table> | Symbolic address | Relative address | <u>StartProg</u> | 0 | Offset | UNKNOWN<br>9 (1) | Value | UNKNOWN (6)<br>14 (1) | <u>EndProg</u> (7) | UNKNOWN (8)<br>8 (9) |
| Symbolic address   | Relative address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                  |                  |                  |   |        |                  |       |                       |                    |                      |
| <u>StartProg</u>   | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |                  |                  |   |        |                  |       |                       |                    |                      |
| Offset             | UNKNOWN<br>9 (1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                  |                  |                  |   |        |                  |       |                       |                    |                      |
| Value              | UNKNOWN (6)<br>14 (1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                  |                  |   |        |                  |       |                       |                    |                      |
| <u>EndProg</u> (7) | UNKNOWN (8)<br>8 (9)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |                  |                  |   |        |                  |       |                       |                    |                      |

## QUESTION 17.



| Question | Answer                                                                                                                                                                                                                                                                                                                                              | Marks    |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 4(a)(i)  | <p><b>1 mark</b> for each type of addressing</p> <p>Direct addressing</p> <ul style="list-style-type: none"><li>• The operand is the address where the data is stored</li></ul> <p>Indirect addressing</p> <ul style="list-style-type: none"><li>• The operand is an address, that address holds another address where the data is stored</li></ul> | <b>2</b> |



| Question    | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |             |          |          |        |  |   |           |   |  |        |  |   |          |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------|----------|--------|--|---|-----------|---|--|--------|--|---|----------|
| 4(a)(ii)    | <b>1 mark</b> per bullet point<br><br>Direct addressing: <ul style="list-style-type: none"> <li>20 is the address of the data</li> </ul> Indirect addressing: <ul style="list-style-type: none"> <li>20 is an address which holds the address where the data is stored</li> </ul>                                                                                                                                                                                                                                                                                                                                                            |             |          |          |        |  |   |           |   |  |        |  |   |          |
| 4(b)        | <b>1 mark</b> for <b>1</b> correct tick<br><b>2 marks</b> for <b>3</b> correct ticks <table border="1"> <thead> <tr> <th>Instruction</th><th>Symbolic</th><th>Absolute</th></tr> </thead> <tbody> <tr> <td>ADD 90</td><td></td><td>✓</td></tr> <tr> <td>CMP found</td><td>✓</td><td></td></tr> <tr> <td>STO 20</td><td></td><td>✓</td></tr> </tbody> </table>                                                                                                                                                                                                                                                   | Instruction | Symbolic | Absolute | ADD 90 |  | ✓ | CMP found | ✓ |  | STO 20 |  | ✓ | <b>2</b> |
| Instruction | Symbolic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Absolute    |          |          |        |  |   |           |   |  |        |  |   |          |
| ADD 90      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | ✓           |          |          |        |  |   |           |   |  |        |  |   |          |
| CMP found   | ✓                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |          |          |        |  |   |           |   |  |        |  |   |          |
| STO 20      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | ✓           |          |          |        |  |   |           |   |  |        |  |   |          |
| 4(c)(i)     | 186                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>1</b>    |          |          |        |  |   |           |   |  |        |  |   |          |
| 4(c)(ii)    | BA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>1</b>    |          |          |        |  |   |           |   |  |        |  |   |          |
| 4(c)(iii)   | −70                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>1</b>    |          |          |        |  |   |           |   |  |        |  |   |          |
| 4(d)        | <b>1 mark</b> per bullet point <ul style="list-style-type: none"> <li>Outputting * (instruction 71)</li> <li>Storing 130 in 203 (instruction 72)</li> <li>Loading, incrementing accumulator and storing in 204 (instructions 73, 74 and 75)</li> <li>Incrementing Index Register (instruction 76)</li> <li>Loading 133, comparing and jumping to 81 (instructions 77, 78 and 79)</li> <li>Loading, comparing and jumping to 74 (instructions 81, 82 and 83)</li> <li>Incrementing accumulator, storing in 204 and incrementing index register, loading 130 (instructions 74–79)</li> <li>Outputting * to end (instructions 80–84)</li> </ul> | <b>8</b>    |          |          |        |  |   |           |   |  |        |  |   |          |

[illegible]

## QUESTION 18.



| Question | Answer                                                                                                                                                                                                                                                                                                                                                                       | Marks    |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 3(a)(i)  | <b>1 mark</b> per bullet point<br>Absolute addressing: <ul style="list-style-type: none"><li>The operand is a numeric address // The numeric address is given // referring directly to a memory location</li></ul> Symbolic addressing: <ul style="list-style-type: none"><li>The operand is a word/symbol // A word/symbol represents the memory location/address</li></ul> | <b>2</b> |
| 3(a)(ii) | <b>1 mark</b> per example<br><br>Absolute addressing: For example, <code>ADD 230</code><br><br>Symbolic addressing: For example, <code>ADD num1</code>                                                                                                                                                                                                                       | <b>2</b> |
| 3(b)(i)  | <b>1 mark</b> per bullet point<br><br>Indexed addressing: <ul style="list-style-type: none"><li>The address to be used is formed by:<br/>operand + the contents of the Index Register (IX)</li></ul> Immediate addressing: <ul style="list-style-type: none"><li>The operand is not an address // the operand is the actual value to be loaded</li></ul>                     | <b>2</b> |



| Question  | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |          |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 3(b)(ii)  | <b>1 mark per example</b><br><br>Indexed: For example, LDX 20<br><br>Immediate: For example, ADD #20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |          |
| 3(c)(i)   | 193                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>1</b> |
| 3(c)(ii)  | C1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>1</b> |
| 3(c)(iii) | –63                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>1</b> |
| 3(d)      | <b>1 mark per bullet point</b> <ul style="list-style-type: none"> <li>• Loading 2, comparing with 104 (instructions 40 and 41)</li> <li>• Loading 302 (instruction 43)</li> <li>• Comparing, and branching to 47 (instructions 44, 45)</li> <li>• Loading, decrementing accumulator and storing (instructions 47, 48 and 49)</li> <li>• Incrementing Index Register (instruction 50)</li> <li>• Loading 303, comparing and outputting + (instructions 43–46)</li> <li>• Loading, decrementing accumulator and storing, incrementing Index Register and end (instructions 47–51, 41, 42 and 54)</li> </ul> | <b>7</b> |

[illegible]

## QUESTION 19.



| Question | Answer                                                                                                                                                                                                                                                                                                                                                 | Marks    |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 2(a)     | <b>1 mark</b> per bullet point<br><br>Relative addressing: <ul style="list-style-type: none"><li>• A number (the offset) is added to the base address to give the actual address</li></ul><br>Indexed addressing: <ul style="list-style-type: none"><li>• The contents of the index register are added to operand to give the actual address</li></ul> | <b>2</b> |
| 2(b)(i)  | <b>242</b>                                                                                                                                                                                                                                                                                                                                             | <b>1</b> |



| Question  | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|---|---|---|---|
| 2(b)(ii)  | F2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |
| 2(b)(iii) | −14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |
| 2(b)(iv)  | <table border="1"><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                             |   |   |   |   |   |   |  | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 |
| 1         | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1 | 1 | 0 | 0 | 1 | 1 |  |   |   |   |   |   |   |   |   |   |
| 2(c)      | <p><b>1 mark per bullet point</b></p> <ul style="list-style-type: none"><li>• Loading 8 (instruction 20)</li><li>• Comparison and loading 453 (instructions 21–23)</li><li>• Outputting &amp; (instruction 26)</li><li>• Loading, incrementing and storing in 96 (instructions 27–29)</li><li>• Incrementing Index Register (instruction 30)</li><li>• Jumping and loading 452 (instruction 23)</li><li>• Jumping, loading, incrementing, storing in 96, incrementing IX and end (instructions 24–32)</li></ul> |   |   |   |   |   |   |  | 7 |   |   |   |   |   |   |   |   |



| Instruction address | ACC | Memory address |     |     |    |    |     | IX |   |
|---------------------|-----|----------------|-----|-----|----|----|-----|----|---|
|                     |     | 93             | 94  | 95  | 96 | 97 | 98  |    |   |
|                     |     | 453            | 453 | 452 | 8  | 10 | 453 | 8  |   |
| 20                  | 8   |                |     |     |    |    |     |    |   |
| 21                  |     |                |     |     |    |    |     |    |   |
| 22                  |     |                |     |     |    |    |     |    |   |
| 23                  | 453 |                |     |     |    |    |     |    |   |
| 24                  |     |                |     |     |    |    |     |    |   |
| 25                  |     |                |     |     |    |    |     |    |   |
| 26                  |     |                |     |     |    |    |     |    | & |
| 27                  | 8   |                |     |     |    |    |     |    |   |

## QUESTION 20.



| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |             |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|
| 5(a)     | 1 mark for two correct ticks, 2 marks for three correct ticks                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |             |
|          | Task                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | First pass | Second pass |
|          | Creation of symbol table                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ✓          |             |
|          | Expansion of macros                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ✓          |             |
|          | Generation of object code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            | ✓           |
|          | Removal of comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ✓          |             |
| 5(b)     | 1 mark per bullet point to max 2 <ul style="list-style-type: none"><li>• Data movement</li><li>• Input and output of data</li><li>• Arithmetic operations</li><li>• Jump instructions</li><li>• Compare instructions</li></ul>                                                                                                                                                                                                                                                                             |            | 2           |
| 5(c)     | 1 mark per bullet point <ul style="list-style-type: none"><li>• Storing 0 in 300 (line 21)</li><li>• Loading 65 (line 28)</li><li>• Outputting A (line 29)</li><li>• Loading 0 (line 30), incrementing ACC (line 31) and storing in 300 (line 32)</li><li>• Incrementing IX (line 33)</li><li>• Loading 67 (line 24) and adding 33 (line (25)</li><li>• Outputting d (line 26)</li><li>• Loading 1 (line 30), incrementing ACC (line 31), storing in 300 (line 32) and incrementing IX (line 33)</li></ul> |            | 8           |

[illegible]

## QUESTION 21.



| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Marks    |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 3(a)     | <p><b>1 mark</b> for each error <b>and</b> correction</p> <ul style="list-style-type: none"><li>• Line 02 should be +1 not -1 // <math>PC \leftarrow [PC] + 1</math></li><li>• Line 03 should be double brackets around MAR // <math>MDR \leftarrow [[MAR]]</math></li><li>• Line 04 should be MDR not MAR // <math>CIR \leftarrow [MDR]</math></li></ul>                                                                                                                                                                                                                                                         | <b>3</b> |
| 3(b)     | <p><b>1 mark</b> for each group to <b>max. 2</b></p> <ul style="list-style-type: none"><li>• Data movement</li><li>• Arithmetic operations</li><li>• (Unconditional and conditional) jump instructions</li><li>• Compare instructions</li><li>• Modes of addressing</li></ul>                                                                                                                                                                                                                                                                                                                                     | <b>2</b> |
| 3(c)     | <p><b>1 mark</b> per bullet</p> <ul style="list-style-type: none"><li>• Storing 0 in 401 (line 51)</li><li>• Loading memory location 300, value 2 to ACC (line 52)</li><li>• Adding 64 to ACC to give 66 (line 55)</li><li>• Outputting B (line 56)</li><li>• Load 0 (line 57), increment ACC (line 58) and store 1 in 401 (line 59)</li><li>• Incrementing IX (line 60)</li><li>• Loading 5 (line 52), adding 64 (line 55), outputting E (line 56) loading 1 (line 57), incrementing ACC (line 58), storing 2 in 401 (line 59) and incrementing IX (line 60)</li><li>• Load 0 (line 52) <u>and end</u></li></ul> | <b>8</b> |





| Question  | Answer                                            |          |
|-----------|---------------------------------------------------|----------|
| 3(d)(i)   | <b>1 mark</b> for correct answer<br><br>0100 0001 |          |
| 3(d)(ii)  | <b>1 mark</b> for correct answer<br><br>41        | <b>1</b> |
| 3(d)(iii) | <b>1 mark</b> for correct answer<br><br>0044      | <b>1</b> |

## QUESTION 22.



| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Marks            |                      |                  |                      |               |        |                                         |  |  |   |        |                          |  |   |  |        |                                       |   |  |  |         |                                 |  |   |  |          |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------------------|------------------|----------------------|---------------|--------|-----------------------------------------|--|--|---|--------|--------------------------|--|---|--|--------|---------------------------------------|---|--|--|---------|---------------------------------|--|---|--|----------|
| 4(a)     | <p><b>1 mark</b> per bullet</p> <ul style="list-style-type: none"><li>LDM #300    The (denary) number 300 is loaded (into the register)</li><li>LDD 300    The <u>contents</u> of address 300 are loaded (into the register)</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                             | <b>2</b>         |                      |                  |                      |               |        |                                         |  |  |   |        |                          |  |   |  |        |                                       |   |  |  |         |                                 |  |   |  |          |
| 4(b)     | <p><b>1 mark</b> for JPN correct<br/><b>1 mark</b> for both of ADD and DEC correct<br/><b>1 mark</b> for LDR correct</p> <table><tr><th></th><th>Description</th><th>Jump instruction</th><th>Arithmetic operation</th><th>Data movement</th></tr><tr><td>LDR #3</td><td>Load the number 3 to the Index Register</td><td></td><td></td><td>✓</td></tr><tr><td>ADD #2</td><td>Add 2 to the Accumulator</td><td></td><td>✓</td><td></td></tr><tr><td>JPN 22</td><td>Move to the instruction at address 22</td><td>✓</td><td></td><td></td></tr><tr><td>DEC ACC</td><td>Subtract 1 from the Accumulator</td><td></td><td>✓</td><td></td></tr></table> |                  | Description          | Jump instruction | Arithmetic operation | Data movement | LDR #3 | Load the number 3 to the Index Register |  |  | ✓ | ADD #2 | Add 2 to the Accumulator |  | ✓ |  | JPN 22 | Move to the instruction at address 22 | ✓ |  |  | DEC ACC | Subtract 1 from the Accumulator |  | ✓ |  | <b>3</b> |
|          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Jump instruction | Arithmetic operation | Data movement    |                      |               |        |                                         |  |  |   |        |                          |  |   |  |        |                                       |   |  |  |         |                                 |  |   |  |          |
| LDR #3   | Load the number 3 to the Index Register                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |                      | ✓                |                      |               |        |                                         |  |  |   |        |                          |  |   |  |        |                                       |   |  |  |         |                                 |  |   |  |          |
| ADD #2   | Add 2 to the Accumulator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  | ✓                    |                  |                      |               |        |                                         |  |  |   |        |                          |  |   |  |        |                                       |   |  |  |         |                                 |  |   |  |          |
| JPN 22   | Move to the instruction at address 22                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | ✓                |                      |                  |                      |               |        |                                         |  |  |   |        |                          |  |   |  |        |                                       |   |  |  |         |                                 |  |   |  |          |
| DEC ACC  | Subtract 1 from the Accumulator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  | ✓                    |                  |                      |               |        |                                         |  |  |   |        |                          |  |   |  |        |                                       |   |  |  |         |                                 |  |   |  |          |



| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |          |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 4(c)(i)  | <p><b>1 mark</b> for hardware interrupt <b>1 mark</b> for software interrupt</p> <p>For example:</p> <p>Hardware interrupt</p> <ul style="list-style-type: none"> <li>• Printer out of paper</li> <li>• No CD in drive</li> </ul> <p>Software interrupt</p> <ul style="list-style-type: none"> <li>• A running program needs input</li> <li>• Runtime error, e.g. division by zero</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |          |
| 4(c)(ii) | <p><b>1 mark</b> per bullet to <b>max 5</b></p> <ul style="list-style-type: none"> <li>• At the start / end of each fetch-execute cycle the processor checks for interrupt(s)</li> <li>• Check if an interrupt flag is set // Check if bit set in interrupt register</li> <li>• Processor identifies source of interrupt</li> <li>• Processor checks priority of interrupt</li> <li>• If interrupt priority is high enough // Lower priority interrupts are disabled</li> <li>• Processor saves current contents of registers // saves current job on stack</li> <li>• Processor calls interrupt handler / Interrupt Service Routine (ISR)</li> <li>• Address of ISR is loaded into Program Counter (PC)</li> <li>• When servicing of interrupt complete, processor restores registers // job from stack is restored</li> <li>• Lower priority interrupts are re-enabled</li> <li>• Processor continues with next F–E cycle</li> </ul> | <b>5</b> |