

QUESTION 1.



6 (a)

Description of use	Input or output device
input of credit card number into an online form	Keyboard/keypad/numberpad
selection of an option at an airport information kiosk	touch screen
output of a single high quality photograph	ink jet printer
output of several hundred high quality leaflets	laser printer
input of a hard copy image into a computer	scanner

[5]

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

- frequent (or equivalent) backup EITHER to secondary media/to 3rd party server/cloud/removable devices/continuous backup OR stored remotely
- disk-mirroring strategy/RAID
- UPS (uninterruptable power supply)/backup generator

[2]

(ii) Any **one** from:

- protection of data (or equivalent) with passwords/using password and username for logging on include e.g. fingerprint scanning
- encryption
- installation and use of up to date anti-malware/anti-virus
- give different access rights to different users
- use a firewall,
- physical methods/lock doors and use secure entry devices/CCTV

[1]

QUESTION 2.



- 3 (a) maximum of **two marks** for firewall description + maximum of **two marks** for authentication description

Firewall

- sits between the computer or LAN and the Internet/WAN and permits or blocks traffic to/from the network
- can be software and/or hardware
- software firewall can make precise decisions about what to allow or block as it can detect illegal attempts by specific software to connect to Internet
- can help to block hacking or viruses reaching a computer

Authentication

- process of determining whether somebody/something is who/what they claim to be
- frequently done through log on passwords/biometrics
- because passwords can be stolen/cracked, digital certification is used
- helps to prevent unauthorised access to data

[3]

- (b) **one** mark for security, **one** mark for integrity:

- integrity deals with validity of data/freedom from errors/data is reasonable
- security deals with protection of data
- security protects data from illegal access/loss
- integrity deals with making sure data is not corrupted after, for example, being transmitted

[2]

- (c) (i) **one mark** for each way of maintaining data security + **one mark** for an example/enhancement

- validation (to ensure data is reasonable)
- examples include range checks, type checks, length checks, ...
- verification (checks if data input matches original/if transmitted data matches original)
- can use double data entry or visual check/other methods such as parity checks
- doesn't check whether or not data is reasonable

[3]

- (ii) **one mark** for each way of maintaining data integrity + **one mark** for an example/enhancement

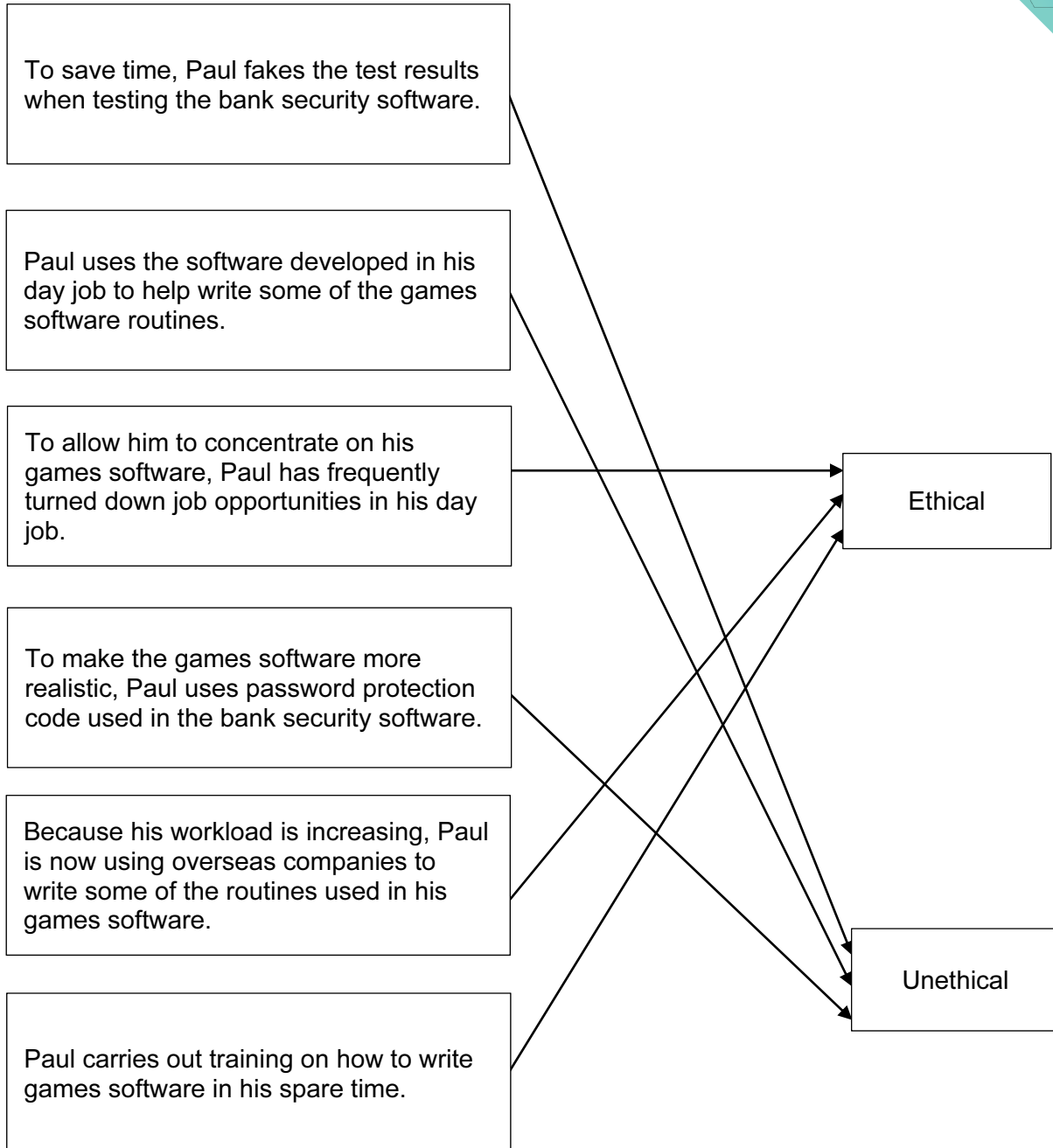
- parity checking
- one of the bits is reserved as parity bit
- e.g. 1 0 1 1 0 1 1 0 uses odd parity
- number of 1s must be odd
- parity is checked at receiver's end
- a change in parity indicates data corruption
- check sum
- adds up bytes in data being sent and sends check sum with the data
- calculation is re-done at receiver's end
- if not the same sum then the data has been corrupted during transmission

[3]

QUESTION 3.



4



1 mark for each correct line, two lines from one box is incorrect

[6]

QUESTION 4.



8 (a) (i) Database Management System

- (ii) **One mark** for identifying the way in which the data security is ensured, and **one mark** for a further description.

Maximum of two marks per method. **Maximum of two methods.**

[4]

- Issue usernames and passwords...
 - stops unauthorised access to the data
 - any further expansion e.g. strong passwords / passwords should be changed regularly etc...
- Access rights / privileges...
 - so that only relevant staff / certain usernames can read/edit certain parts of the data
 - can be read only, or full access / read, write and delete
 - any relevant example e.g. only class tutors can edit details of pupils in their tutor group
- Create (regular / scheduled) backups...
 - in case of loss/damage to the live data a copy is available
 - any relevant example e.g. backing up the attendance registers at the end of each day and storing the data off-site/to a separate device
- Encryption of data...
 - if there is unauthorised access to the data it cannot be understood // needs a decryption key
 - any relevant example e.g. personal details of pupils are encrypted before being sent over the Internet to examination boards
- Definition of different views...
 - composed of one or more tables
 - controls the scope of the data accessible to authorised users
 - any relevant example e.g. teachers can only see their classes
- Usage monitoring / logging of activity...
 - creation of an audit /activity log
 - records the use of the data in the database / records operations performed by all users / all access to the data
 - any relevant example, e.g. Track who changed a student's grade

- (iii) **Two points** from:

[2]

- Set up search criteria
- To find / retrieve / return the data that matches the criteria
- Any relevant example e.g. find pupils who were absent on a particular day



(iv) Three points from:

- By storing data in (separate) linked tables data redundancy is reduced / data duplication is controlled...
- Compatibility / data integrity issues are reduced as data only needs to be updated once / is only stored once.
- Unwanted or accidental deletion of linked data is prevented as the DBMS will flag an error.
- Program - data dependence is overcome.
- Changes made to the structure of the data have little effect on existing programs.
- Ad-hoc / complex queries can be more easily made as the DBMS will have a query language/ QBE form.
- Unproductive maintenance is eliminated as changes only need to be made once (rather than changing multiple programs).
- Fields can be added or removed without any effect on existing programs (that do not use these fields).
- Security / privacy of the data is improved as each application only has access to the fields it needs.
- There is better control of data integrity as the DBMS (uses its Data Dictionary) to perform validation checks on data entered.

(b) (i) Two points from:

[2]

- The Primary Key in **CLASS** is ClassID
- The Foreign Key of **CLASS-GROUP** is ClassID.
- The Primary Key of **CLASS** is also included in **CLASS-GROUP** as a Foreign Key, (which links to **CLASS** table)

(ii) Many-to-one

[1]

(iii) One mark per statement. Several statements may be on the same line.

[4]

```
SELECT StudentID, FirstName
FROM STUDENT
WHERE TutorGroup = "10B" // WHERE (TutorGroup = "10B")
ORDER BY LastName ASC;
```

Page 9	Mark Scheme	
	Cambridge International AS/A Level – May/June 2016	



(iv) **One mark** per statement. Several statements may be on the same line.

```
SELECT STUDENT.LastName  
FROM STUDENT, CLASS-GROUP  
WHERE ClassID = "CS1" // WHERE (ClassID = "CS1")  
AND CLASS-GROUP.StudentID = STUDENT.StudentID;
```

One mark per statement. Several statements may be on the same line.

```
SELECT STUDENT.LastName  
FROM STUDENT INNER JOIN CLASS-GROUP  
ON CLASS-GROUP.StudentID = STUDENT.StudentID  
WHERE ClassID = "CS1" // WHERE (ClassID = "CS1").
```

QUESTION 5.



7 (a) Four from:

[4]

- Security is keeping the data safe.
- Integrity is making sure that the data is correct / valid.
- Security is the prevention of data loss.
- Integrity ensures that the data received is the same as the data sent / data copied is the same as the original.
- Example of ensuring security, e.g. usernames and passwords, firewalls etc...
- Example of ensuring integrity, e.g. parity checks, double entry etc...

(b) Three pairs from:

[6]

- Installing a firewall and ensuring it is switched on.
- To stop unauthorised access / hackers gaining access to the bank's computer network.
- Use authentication methods such as passwords and usernames.
- Passwords should be strong / biometrics.
- Encrypt the data.
- So that if data is accessed it will be meaningless / only accessed by those with decryption key.
- Set up access rights...
- To stop users reading/editing data they are not permitted to access.
- Installing and running an up to date anti-malware program (anti-virus/anti-spyware etc.).
- To detect / remove / quarantine viruses / key-loggers etc.
- Make regular backups of the data.
- To separate device or off site to enable recovery if necessary.
- Employ measures for physical security.
- Example of a measure for physical security.

QUESTION 6.

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.

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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 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)	One mark from: - The program code can be translated to run on any processor / platform - Source code is translated into machine independent intermediate code not machine dependent code	1



Question	Answer
2(b)(ii)	Two marks from: • Java uses a two-step translation process • Java code is partially interpreted – partially compiled • Code is translated first into intermediate code / "bytecode"... • ...using the Java compiler • The bytecode is finally interpreted by the Java Virtual Machine

Question	Answer	Marks																																													
3(a)	Two marks from: - Physical measures - Access rights - Encryption - Firewall - Use authentication methods such as usernames and passwords - Anti-malware program	Max 2																																													
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> 1 mark for 6 values 1 mark for 2 steps Accept 128 MOD 11 = 7 1 mark for subtraction Answer: 786531 4 (1 mark for answer)	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	4
7	X	6	=	42																																											
8	X	5	=	40																																											
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3	X	2	=	6																																											
1	X	1	=	1																																											
			Total:	128 / 11																																											
				11 R 7																																											
Check digit:				11 – 7 = 4																																											
3(b)(ii)	One mark for name of check One mark for description Max two checks Uniqueness check Each PatientID must be unique Length check Each PatientID is exactly 7 characters Format check / Type check All 7 characters must be <u>digits</u> Presence check PatientID must be entered	Max 4																																													



Question	Answer																															
4(a)	A – System clock B – Control unit C – Main memory E – Control bus 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> (1) (1) + (1) (1) (1)	ACC	CountDown	OUTPUT		15		67		C	15			14	14		51		3	14			13	13		32			88		x	5
ACC	CountDown	OUTPUT																														
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14	14																															
51		3																														
14																																
13	13																															
32																																
88		x																														
4(c)	Three marks from: - The assembler scans the assembly language instructions in sequence - When it meets a symbolic address checks to see if already in symbol table - If not, it adds it to the symbol table in the symbolic address column - If it is already in symbol table check if absolute address known - If the absolute address is known, it is entered in the appropriate cell - If the absolute address is not known mark / leave as unknown	Max 3																														
4(d)(i)	The op code / mnemonic / instruction table	1																														
4(d)(ii)	A – 1110 0110 0110 1000 (1) (1) B – E6 68 (1)	3																														



Question	Answer	
5(a)(i)	Three marks from: • Diaphragm / cone • (Voice) coil of wire • Spider / Suspension • (Permanent) Magnet • Basket • Dust cap • Outer frame	
5(a)(ii)	Four marks from: • Takes an electrical signal and translates it into physical vibrations to create sound waves • An electric current in the coil creates an electro-magnetic field • Changes in the audio signal causes the direction of the electric current to change • 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 • The electro-magnet is repelled by or attracted to the permanent magnet • Causing the coil to vibrate • The movement of the coil causes the cone / diaphragm to vibrate • That vibration is transmitted to the air in front of the cone / diaphragm as sound waves • The amount of movement will determine the frequency and amplitude of the sound wave produced	Max 4
5(b)(i)	One mark from: • External hard disk drive // SSD • External CD / DVD drive • Pen drive • Blu-ray drive	1
5(b)(ii)	Two marks from: • Additional secondary file storage // storing files • Backup of files • Archiving of files • Transfer files to second computer	Max 2



Question	Answer	
6(a)	Two marks from: - A system of moral principles - That guide behaviour / decision making - Based on philosophical / religious views - By example, e.g. respectful and considerate behaviour	
6(b)	One mark for identifying the issue One mark for correct principle One mark for possible action Max 2 issues (2 × 3 marks) 1 Uncomfortable with one of his colleagues Client and Employer // Management / Colleagues // Judgement // Self For example: Team building exercises // arranged meeting 2 Unfamiliar with programming language Self // Client and Employer // Product // Profession // Colleagues For example: Undergo training 3 Visit to unfamiliar workplace Client and employer // Management // Judgement // Profession // Colleagues For example: He should speak to his manager to discuss situation	Max 6

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



Question	Answer	
7(b)	Two marks from: Either: - Add an attribute (for example <code>Attended</code>) - To the appointment table // <code>APPOINTMENT</code> Or: - Add an attribute (for example <code>AppointmentsMissed</code>) - To the patient table // <code>PATIENT</code>	
7(c)(i)	Available to work at both <code>SITE-A</code> and <code>SITE-B</code>	1
7(c)(ii)	<code>APPOINTMENT(Site, AppointmentDate, AppointmentTime, DoctorID, PatientID)</code>	1
7(d)(i)	One mark per line <code>UPDATE DOCTOR</code> <code>SET DoctorID = '017'</code> <code>WHERE DoctorID = '117';</code>	3
7(d)(ii)	1 Mark per bullet, max 2 - Referential integrity should be maintained // Referential integrity could be violated. - Data becomes inconsistent - There may be records in the <code>APPOINTMENT</code> table showing doctor ID 117 - The <code>APPOINTMENT</code> table might not be automatically updated - Records in the <code>APPOINTMENT</code> table will become orphaned	Max 2
7(e)	One mark per line <code>SELECT AppointmentDate, AppointmentTime</code> <code>FROM APPOINTMENT</code> <code>WHERE PatientID = '556';</code>	3

QUESTION 7.



	For example: Personal data of students / staff	
3(b)	1 Mark for stating the security measure 1 Mark for a corresponding description Maximum 2 marks for each measure Maximum 2 measures Physical measures • Locked doors/keyboards etc. • Secure methods of access, keypads/ biometric scans etc. Backup of data • Regular copies of the data are made • If the data is corrupted it can be restored Disk-mirroring • All activity is duplicated to a second disk in real time so that if the first disk fails there is a complete copy available Access rights • Different access rights for individuals/groups of users • To stop users editing data they are not permitted to access • By example Encryption • If accessed, data cannot be understood by unauthorised personnel • Accessed only by those with the decryption key Firewall • To stop unauthorised access/hackers gaining access to the computer network Use authentication methods such as passwords and usernames • Passwords should be strong / biometrics • To prevent unauthorised access to data Anti-malware program • To detect / remove / quarantine viruses / key-loggers etc. • Carrying out regular scans Concurrent Access Controls // Record locking • Closes a record to second user until first update complete • To prevent simultaneous updates being lost	4



Question	Answer
3(c)	1 Mark per bullet, max 2 • Checking that the data entered matches / is consistent with that of the source. • Comparison of two versions of the data • Examples include double entry, visual checking, proof reading etc... • In the event of a mismatch – the user is forced to re-enter the data • By example, e.g. creation of a password • Does not check data is sensible/acceptable

QUESTION 8.



Question	Answer	Marks
4(a)	1 mark for naming a principle, 1 mark for description to max 3 × 2 • Product • Software engineers shall ensure that their products and related modifications meet the highest professional standards possible. • Judgement • Software engineers shall maintain integrity and independence in their professional judgement. • Management • Software engineering managers and leaders shall subscribe to and promote an ethical approach to the management of software development and maintenance. • Profession • Software engineers shall advance the integrity and reputation of the profession consistent with the public interest. • Colleagues • Software engineers shall be fair to and supportive of their colleagues. • Self • Software engineers shall participate in life-long learning regarding the practice of their profession and shall promote an ethical approach to the practice of the profession.	6
4(b)	1 mark per bullet point to max 2 × 2 Data backup • A copy of data will have been made and stored elsewhere. • If the original is lost, the backup can be used to restore the data. Disk-mirroring • The data is stored on two disks simultaneously. • If the first disk drive fails, the data is accessed from the second disk.	4

QUESTION 9.



Question	Answer	Marks
5(a)(i)	1 mark for correct answer <u>Repeated</u> / <u>duplicated</u> data	1
5(a)(ii)	1 mark per bullet point • Because each record/piece of data is stored once <u>and</u> is referenced by a (primary) key • Because data is stored in individual tables • ...and the tables are linked by relationships • By the proper use of Primary and Foreign keys • By enforcing referential integrity • By going through the normalisation process	3
5(b)(i)	1 mark per bullet point • Security ensures that data is safe from unauthorised access // safe from loss • Integrity ensures that data is accurate / consistent / up to date	2



Question	Answer	
5(b)(ii)	1 mark for naming, 1 mark for description For example: • Access rights // User accounts • Restrict actions (e.g. read / read-write) of specific users // unauthorised users cannot access the database • Views • Restrict which parts of the database specific users can see • Password // Biometrics // PIN code • Prevents unauthorised access • Automatic Backup • Create regular copies of data in case of loss • Encryption • Data is incomprehensible to unauthorised users	
5(b)(iii)	1 mark per bullet • Query Processor • Developer Interface	2

QUESTION 10.



Question	Answer	
2(a)	1 mark per bullet point • Security: keep data safe from accidental/malicious damage/loss • Privacy: keep data confidential // only seen by authorised personnel	
2(b)	1 mark for identifying method 2 marks for description to max 2 × 3 For example: • User accounts • User has a username and password Access to resources can be limited to specific accounts • Cannot access <u>system</u> without valid username and password // prevents unauthorised access to the <u>system</u> • Firewall • All incoming and outgoing network traffic goes through firewall • Blocks signals that do not meet requirements • Keeps a log of signals • Applications can have network access restricted • Anti-malware • Scans for malicious software • Quarantines or deletes any malicious software found • Scans can be scheduled at regular intervals • Should be kept up to date • Auditing • Logging all actions/changes to the system • In order to identify any unauthorised use • Application Security (accept equivalent) • Applying regular updates / patches • Finding, fixing and preventing security vulnerabilities in any (installed) application	6
2(c)(i)	1 mark per bullet to max 4 • Each byte has a parity bit // horizontal parity • An additional parity byte is sent with vertical (and horizontal) parity • Each row and column must have an <u>even/odd number of 1s</u> • Identify the incorrect row and column • The intersection is the error	4
2(c)(ii)	1 mark for correct answer • Errors in an even number of bits (could cancel each other out)	1



Question	Answer	
2(d)	1 mark per bullet point to max 3 For example: He should ... • ...Keep the client's personal data private • ...Involve the client in the development // ...Communicate with the client • ...Provide the solution that the client asked for • ...Keep the project running on time // budget • ...Keep the client informed of any problems/delays	
2(e)	1 mark per bullet point to max 3 • He uses a compiler because it creates a separate executable file • The executable means the client cannot access the source code // edit the program • The executable means the client does not need the IDE / compiler • It will (probably) be faster to run the executable than to interpret the source code every time the program is run	3

QUESTION 11.



Question	Answer													
1(a)(i)	1 mark per input device to max 2 e.g. - Barcode scanner / Infra-red scanner - Pressure sensor - RFID / chip reader - Bank note scanner - Pin / key pad - Magnetic strip reader													
1(a)(ii)	1 mark per output device to max 2 e.g. - Speaker - Printer - LCD screen	2												
1(a)(iii)	1 mark for at least two statements in the correct position, 2 marks for all four statements in correct position. 1 B (The screen has a layer that stores an electrical charge) 2 <i>When the user touches the screen</i> 3 A (Charge is drawn to the point of contact) 4 C (There is a change in the electrostatic field) 5 <i>The coordinates of the point of contact can be calculated</i> 6 D (These coordinates are sent to the touchscreen driver)	2												
1(b)(i)	1 mark per bullet point to max 2 - To store the files needed to boot the system - To store parts of the self-checkout machine operating system - To store the self-checkout machine software - To store the intermediate data / running total for items purchased	2												
1(b)(ii)	1 mark for at least one correct row, 2 marks for all three correct rows <table border="1" data-bbox="317 1473 1139 1733"> <thead> <tr> <th>Statement</th><th>SRAM</th><th>DRAM</th></tr> </thead> <tbody> <tr> <td>More expensive to make</td><td>✓</td><td></td></tr> <tr> <td>Requires refreshing (recharging)</td><td></td><td>✓</td></tr> <tr> <td>Made from flip-flops</td><td>✓</td><td></td></tr> </tbody> </table>	Statement	SRAM	DRAM	More expensive to make	✓		Requires refreshing (recharging)		✓	Made from flip-flops	✓		2
Statement	SRAM	DRAM												
More expensive to make	✓													
Requires refreshing (recharging)		✓												
Made from flip-flops	✓													



Question	Answer	
1(c)(i)	1 mark per bullet point to max 3 plus 1 mark for suitable example • When a barcode on an item is scanned • ... the server performs any requested tasks // the server looks up the details of the product • The self-checkout machine is a client • ... that send requests to the server // the self-checkout machine asks for, e.g. the price of the item • The server returns the results of the request // the server returns e.g. the item price • Self-checkout machine displays e.g. price to the user	
1(c)(ii)	1 mark for each security method to max 2, 1 mark for integrity Security • encryption • access rights • username and password // biometrics // user accounts • backup // disk mirroring • firewall • Physical methods (e.g. CCTV, locked rooms etc.) Integrity • checksum • parity • validation on input	3