

QUESTION 3.



6 (a)	Description Protocol used email client downloads an email from an email server email is transferred from one email server to another email server email client sends email to email server browser sends a request for a web page to a web server HTTP POP3 SMTP	1 mark for correct arrow from each description
(b)	peer-to-peer	1
(c) (i)	Tracker: central server that: stores details of other computers that have all / part of file to be downloaded // has data on those peers downloading and uploading file // shares IP addresses with other clients in swarm allowing them to connect	1 1
(ii)	Seed: peer computer that has 100% of file // is uploading downloaded content	1 1
(iii)	Swarm: all the connected peer computers that have all or part of the file to be downloaded / uploaded // share a torrent	1 1
		Total: 11

QUESTION 4.



6 (a)	Control system	
(b)	Any three different items – max 6 marks heater / water pump / blinds pump ... for altering temperature / watering / light level actuator for... fan for distributing air / water pump / blinds motor analogue to digital converter / digital to analogue convertor ... converts analogue signal from sensor to digital value for processing / converts digital signal to analogue signal for controlling actuator microprocessor ... executes control software warning device (speaker/buzzer/light)... to give warning if conditions out of range / hardware malfunction	1 1 1 1 1 1 1 1 1 max 6
(c) (i)	output of system (alter temperature / light level / soil moisture) affects input from sensors continuous	3
(ii)	min / max / ideal / mean / extreme temperature // sampling rate // tolerance interval	1
(iii)	reading from sensor is compared with parameter appropriate action is taken (by example)	2
(d) (i)	reading available for processing reading value is 4	1 1
(ii)	AND #B00000100 // AND #04 // AND #4 1 mark for AND, 1 mark for address mode, 1 mark for mask, 1 mark for indication of numbering system	max 3
		Total: 18

QUESTION 5.



3 (a) Any point 1 mark

sender's IP address
receiver's IP address
packet sequence number
checksum

[Max 2]

(b) Any point 1 mark

email has been split up into packets
packet has destination address
packets pass through many different routers in journey
packets don't take same route
routers use IP addresses
packets reassembled at destination to rebuild email

[Max 3]

(c) Any point 1 mark

email message is only read when all of it is received
time delays due to lost/delayed packets not significant
so sending different packets by different routes is not issue/is efficient
packets arriving out of order not an issue
no requirement for a continuous circuit (circuit switching)

[Max 2]

(d) Circuit switching

[1]

(e) e.g. real-time video/video conferencing

[1]

Any point 1 mark

circuit made available is dedicated to this communication stream
full bandwidth available/no sharing
no lost packets
guaranteed quality of service

[Max 2]

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Mark Scheme

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QUESTION 6.



- 6 (a) **blocked → ready:**
process is waiting for resource/I/O operation to complete (blocked state) [1]
when I/O operation completed process goes into ready queue (ready state) [1]
running → ready:
when process is executing it is allocated a time slice (running state) // process is allocated time on processor [1]
when time slice completed/interrupt occurs process can no longer use processor even though it is capable of further processing (ready state) [1]
- (b) to be in blocked state process must initiate some I/O operation [1]
to initiate operation process must be executing [1]
if process in ready state cannot be executing/must be in running state [1]
- (c) (i) exit/termination/completion [1]
(ii) when the process has finished execution [1]
- (d) **low-level scheduler:**
decides which of the processes in ready state [1]
should get use of processor/be put in running state [1]
based on position/priority [1]
invoked after interrupt/OS call [1]
[max. 2]

[Total: 11]

QUESTION 7.



6 (a) (i)	Monitoring system	1
(ii)	This is not a 'feedback' system // There is no 'control' taking place/use of actuators // No output other than from alarm	1



(b)	Examples: Pressure ... If intruder steps on sensor Infra-red ... If beam cut by intruder Motion / ultrasonic... Detects any movement in an area Contact / magnetic ... If door / window opened	 1 - 1 - justific Maximum 2 sensors Max 4																																																																																
(c) (i)	<table><thead><tr><th>BITREG</th><th>COUNT</th><th>VALUE</th><th>ACC</th></tr></thead><tbody><tr><td>B00001010</td><td>0</td><td>1</td><td>B00001010</td></tr><tr><td></td><td></td><td></td><td>B00000000</td></tr><tr><td></td><td></td><td></td><td>1</td></tr><tr><td></td><td></td><td>2</td><td>2</td></tr><tr><td></td><td></td><td></td><td>B00001010</td></tr><tr><td></td><td></td><td></td><td>B00000010</td></tr><tr><td></td><td></td><td></td><td>0</td></tr><tr><td></td><td>1</td><td></td><td>1</td></tr><tr><td></td><td></td><td></td><td>2</td></tr><tr><td></td><td></td><td>4</td><td>4</td></tr><tr><td></td><td></td><td></td><td>B00001010</td></tr><tr><td></td><td></td><td></td><td>B00000000</td></tr><tr><td></td><td></td><td></td><td>4</td></tr><tr><td></td><td></td><td>8</td><td>8</td></tr><tr><td></td><td></td><td></td><td>B00001010</td></tr><tr><td></td><td></td><td></td><td>B00001000</td></tr><tr><td></td><td></td><td></td><td>1</td></tr><tr><td></td><td>2</td><td></td><td>2</td></tr><tr><td></td><td></td><td></td><td>8</td></tr></tbody></table>	BITREG	COUNT	VALUE	ACC	B00001010	0	1	B00001010				B00000000				1			2	2				B00001010				B00000010				0		1		1				2			4	4				B00001010				B00000000				4			8	8				B00001010				B00001000				1		2		2				8	Mark as follows: 1 mark for: COUNT column VALUE column First two values in ACC column Rest of ACC column Max 4
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	CMP #128	1																																																																																

QUESTION 8.

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6 (a)

Description	Term
Malware which attaches itself to another program.	VIRUS
Malware designed to redirect the web browser to a fake website.	PHARMING
Email that encourages the receiver to access a website and give their banking details.	PHISHING

[1]

[1]

(b) (i) Plain text is the original text

[1]

Cipher text is the encrypted version of the plain text

[1]

(ii) Asymmetric keys means that the key used to encrypt (public key) is different from the key used to decrypt (private key)

[1]

Ben acquires Mariah's public key

[1]

Ben encrypts email ...

[1]

using Mariah's public key

[1]

Ben sends encrypted email to Mariah

[1]

Mariah decrypts email ...

[1]

Using her private key

[1]

[Max 4]

QUESTION 9.

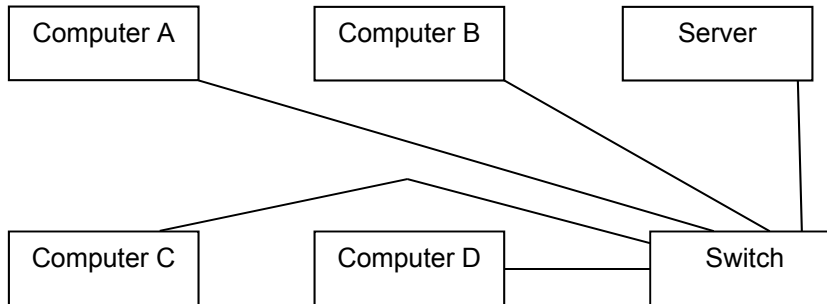
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Computer
Switch
[1]

Server to
Switch
[1]

6 (a)



(b)

Statement	True	False
All packets must be routed via the server.		✓
Computer B can read a copy of the packet sent from the Server to Computer A.		✓
No collisions are possible.	✓	

[1]

[1]

[1]

(c) (i) Router / Switch / Bridge

[1]

(ii) Router uses IP addresses in making decisions

[1]

Router has routing table

[1]

Routing table has entry for associated network ID // routing table has entry for host address // routing table used to make decision on where to route packet

[1]

Switch / Bridge use MAC addresses

[1]

MAC address table created

[1]

Switch / bridge use MAC address table to make decision on where to route packet

[1]

[Max 2]

QUESTION 10.



Question	Answer		
6(a)(i)	Control system		
6(a)(ii)	Use of actuators means that the system is controlling		
6(b)	System wastes processor time checking for values that are not changing Some sensor input needs to be acted upon immediately	1 1	2
6(c)(i)	Interrupts need to be disabled so that the process of dealing with an interrupt is itself not interrupted		1
6(c)(ii)	After handling the interrupt interrupts need to be enabled so that further interrupts can be dealt with		1
6(c)(iii)	Content of <u>registers</u> Placed on stack	1 1	2
6(c)(iv)	Changing sensor value dealt with as soon as it happens Processor needs to check sensor only when an <u>interrupt occurs</u>	1 1	2
6(c)(v)	AND #B00000001000000000 // AND #&0200 // AND #512 Op code Operand	1 1	2

Question	Answer	
6(a)(i)	Monitoring system	
6(a)(ii)	There is no element of 'control' in the system // the system does not alter conditions in the building if sensors triggered	
6(a)(iii)	Any two sensors from: Sound / acoustic Pressure Infra-red / motion /proximity Temperature / Thermal Light Smoke Tilt	Max 2
6(b)(i)	<pre> 01 ForEver ← FALSE //TRUE 02 REPEAT 03 FOR FloorCounter ← 1 TO NoOfFloors 04 FOR SensorCounter ← 1 TO NumberOfSensors 05 READ Sensor(SensorCounter)on Floor(FloorCounter) 06 IF Sensor value outside range 07 THEN 08 OUTPUT "Problem on Floor ", FloorCounter 09 ENDIF 10 ENDFOR 11 ENDFOR 12 // 13 // Delay loop 14 // Delay loop 15 // 16 UNTIL ForEver/Forever = TRUE // NOT ForEver / ForEver = FALSE </pre>	1 1 1 3
6(b)(ii)	FOR Counter ← 1 TO 999999 (any "large" number) ENDFOR	1
6(b)(iii)	To allow time to elapse between readings	1
6(c)(i)	To identify which <u>sensor</u> caused the interrupt	1
6(c)(ii)	Display appropriate warning message On the correct monitor	1 1 2

QUESTION 12.



Question	Answer		
6(a)(i)	Control system		
6(a)(ii)	Use of actuators means that the system is controlling		
6(b)	System wastes processor time checking for values that are not changing Some sensor input needs to be acted upon immediately	1 1	2
6(c)(i)	Interrupts need to be disabled so that the process of dealing with an interrupt is itself not interrupted		1
6(c)(ii)	After handling the interrupt interrupts need to be enabled so that further interrupts can be dealt with		1
6(c)(iii)	Content of <u>registers</u> Placed on stack	1 1	2
6(c)(iv)	Changing sensor value dealt with as soon as it happens Processor needs to check sensor only when an <u>interrupt occurs</u>	1 1	2
6(c)(v)	AND #B00000001000000000 // AND #0200 // AND #512 Op code Operand	1 1	2

QUESTION 13.



Question	Answer	
4(a)(i)	A (known) set of rules Agreed/standard method for data transmission // governs how two devices communicate	1 1
4(a)(ii)	Max 2 marks for purpose: • Purpose of TLS is to provide for secure communication (over a network) • maintain data integrity • additional layer of security Max 2 marks for further explanation from: • TLS provides improved security over SSL • TLS is composed of two layers / record protocol and handshake protocol • TLS protects this information by using encryption • Also allows for authentication of servers and clients	Max 3
4(b)	• The client validates (the server's) TLS Certificate • The client sends its digital certificate (to the server if requested) • Client sends an encrypted message to the server using the server's public key • The server can use its private key to decrypt the message ... • ... and get data needed for generating symmetric key • Both server and client compute symmetric key (to be used for encrypting messages) // session key established • The client sends back a digitally signed acknowledgement to start an encrypted session • The server sends back a digitally signed acknowledgement to start an encrypted session 1 mark for each point, max 3 points	3
4(c)	Applications, for example: • online banking • private email • online shopping • online messaging etc. 1 mark for each point, Max 2	2

Question	Answer	Marks

QUESTION 14.



Question	Answer	
6(a)	One mark for suitable sensor, one mark for justification Max one sensor, max two marks humidity ... to ensure that the plants have the right level of moisture in the air pressure / proximity ... to detect whether the windows are open or closed condone '<i>check</i>' moisture ... to ensure the water levels in the soil are correct light ... to ensure the light levels in the greenhouse are correct for plant growth ... to ensure the windows are closed when night falls Accept pH sensor for one mark only Accept CO₂ sensor for one mark only, accept gas or O₂ for one mark only Justification needs to answer the question why? Not just describe the sensor Accept suitable actions resulting from sensor readings as justification	
6(b)	Three from: • Actions taken by system // or by example: e.g. adjust heater / turn on sprinkler / open windows • May affect the readings taken by the sensors // or by example • Which in turn may cause a change in the actions taken by the system // or by example • This is a continuous process...	3
6(c)(i)	One from: • Lowest allowable temperature • Highest allowable temperature • Sampling time interval	1



Question	Answer	
6(c)(ii)	If answer to c(i) is highest allowable or lowest allowable temperature: - The sensor reading is compared to a stored parameter (1) - Depending upon result of comparison an action may or may not be carried out (1) If answer to c(i) is sampling time interval: - The higher the sampling rate... (1) ...The better / more efficient is the control system (1)	
6(d)(i)	20	1
6(d)(ii)	<pre>LDD 4002 // load the contents of the 16 bit location containing the value for Sensor 5 into the Accumulator LSR #8 // move the bits in the Accumulator so that the Accumulator stores the value of Sensor 5 as unsigned 16-bit binary integer</pre> 1 mark for 4002 1 mark for LSR 1 mark for #8	3

QUESTION 15.



Question	Answer	Marks																				
6(a)	1 mark for each correct row <table><tr><th rowspan="2">Symbol</th><th colspan="2">Token</th></tr><tr><th>Value</th><th>Type</th></tr><tr><td>Start</td><td>60</td><td>Variable</td></tr><tr><td>1</td><td>61</td><td>Constant</td></tr><tr><td>Number</td><td>62</td><td>Variable</td></tr><tr><td>Counter</td><td>63</td><td>Variable</td></tr><tr><td>12</td><td>64</td><td>Constant</td></tr></table>	Symbol	Token		Value	Type	Start	60	Variable	1	61	Constant	Number	62	Variable	Counter	63	Variable	12	64	Constant	3
Symbol	Token																					
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Start	60	Variable																				
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Number	62	Variable																				
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12	64	Constant																				
6(b)	1 mark for each circled section <table><tr><td>60</td><td>01</td><td>61</td><td>51</td><td>62</td><td>4E</td><td>63</td><td>01</td><td>60</td><td>50</td><td>64</td><td>52</td><td>62</td><td>02</td><td>63</td><td>53</td></tr></table>	60	01	61	51	62	4E	63	01	60	50	64	52	62	02	63	53	2				
60	01	61	51	62	4E	63	01	60	50	64	52	62	02	63	53							



Question	Answer	
6(c)	1 mark per bullet point to max 2: - constructing parse tree // parsing - checking the table of tokens to ensure that the rules/syntax/grammar of the language are/is obeyed - producing an error report	
6(d)(i)	shortens execution time of program// time taken to execute whole program decreases	1
6(d)(ii)	1 mark for each of the following: - LDD 236 ADD 237 STO 512 ADD 238 STO 513 ADD 239 STO 514 - Remove line 4 LDD 236 correct lines 3 and 6 in original code - Remove line 5 ADD 237 correct lines 3 and 6 in original code - Remove line 8 and 9 LDD 236 and ADD 237 correct lines 7 and 11 in original code - Remove line 10 ADD 238 correct lines 7 and 11 in original code	5

QUESTION 16.



Question	Answer	
6(a)	1 mark per bullet point (max 3) - To ensure that the system operates within the given criteria - By enabling system output to affect subsequent system inputs - Thus enabling the system to <u>automatically</u> adjust conditions - Suitable example of feedback	
6(b)	1 mark per bullet point - Sensors <u>continually</u> measure the temperature of the <u>water</u> in the swimming pool - The (stream of) readings are sent to a processor and compared with 28 degrees - If the reading is out of range (by a system set amount) then actuators turn the heater/cooler on or off as necessary - Feedback ensures that the water temperature remains close to 28 degrees	4
6(c)	1 mark for example of monitoring system, max 2 for explanation - Suitable example identified - Use of data captured - No feedback as there is no output that could change the system environment For example: - Monitoring the rainfall - The amount of rainfall collected over a specific time is measured - There is no output to change the level of rainfall or - Security camera - Sending pictures to control room - No changes made to environment by system	3

QUESTION 17.



Question	Answer	
8(a)	1 mark per bullet point 1 mark for identifying the state, max 2 for description Max 3 marks for each state • Ready • The process is not being executed • The process is in the queue... • ... waiting for the processor's attention / time slice • Running • The process is being executed by the processor • The process is <u>currently using</u> its allocated processor time / time slice • Blocked • The process is waiting for an event ... • ... so it cannot be executed at the moment • ...e.g. input/output	
8(b)	For up to 2 maximisation techniques for each of memory and disk Max 2 for Memory, Max 2 for disk if no descriptions are given 1 mark for identification of maximisation technique, 1 mark for description, 1 mark for further description or information about improvement to max 4 for memory Memory • Moving frequently accessed instructions to cache (1) for faster recall (1) as SRAM is used rather than DRAM for cache (1) • Making use of virtual memory (1) with paging or segmentation (1) to swap memory to and from a disk (1) • Partitioning memory (1) dividing main memory into static/dynamic partitions (1) to allow for more than one program/task to be available //multiprogramming (1) • Removing unused items/tasks from RAM (1) by marking a partition as available (1) as soon as the process using it has terminated (1) 1 mark for identification of maximisation technique, 1 mark for description, 1 mark for further description or information about improvement to max 4 for disk Disk • Disk caching (1) a disk cache holds data that is frequently transferred to/from the disk (1) the cache can be held on disk or in RAM (1) • Compression utility (1) decreasing the size of a file stored on disk (1) in order fit more / larger files on the disk (1) • Defragmentation utility (1) files are rearranged to occupy contiguous disk space (1) this reduces the time taken to access files// decreases latency (1)	6

QUESTION 18.



Question	Answer	Marks
8(a)(i)	1101	1
8(a)(ii)	011100000000	1
8(a)(iii)	1 mark for positive, 1 for justification • Positive ... • ... the most significant / first bit in the mantissa is 0	2
8(a)(iv)	1 mark per bullet point • Exponent = 1011 = -3 // binary point moved 3 places left • Mantissa 0.111 becomes 0.000111 // $\frac{7}{8}$ // $\frac{1}{2} + \frac{1}{4} + \frac{1}{8}$ // $2^{-1} + 2^{-2} + 2^{-3}$ • Answer: $7 / 64$ // 0.109375	3
8(b)	1 mark per bullet point • Increases the range • Decreases the precision	2