



2008 Computing

Advanced Higher

Finalised Marking Instructions

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SECTION I – Software Development & Developing a Software Solution

Marks

1. (a) (i) **Two** hardware characteristics that affect system performance are: **2 PS**
- Type of backing storage
 - Processor speed
 - Bandwidth
 - Range/bandwidth of wireless
 - Amount of RAM
- Any two answers – 1 mark each.*
- (ii) **Two** other aspects of feasibility that the company would have considered are: **2 KU**
- Economic
 - Time
 - Legal
- Any two answers – 1 mark each.*
- (iii) **Two** benefits of a feasibility study for the company are: **2 KU**
- Smaller initial cost is cheaper than full scale development
 - Provides suggestions of possible solutions
 - Includes a recommended solution where possible
 - A description of the benefit of one of the types of feasibility
- Any two answers – 1 mark each.*
- (b) **Two** elements that would be identified during this stage are: **2 KU**
- Functional requirements
 - Inputs and outputs
 - Scope and boundaries of the problem
 - Budget for project?
 - Hardware characteristics
- Any two answers – 1 mark each.*
- (c) A menu-driven interface would be best for this device because: **2 PS**
- No keyboard for command entry
 - Consistent with other software for the device
 - Lower memory requirements required than for a graphical
 - Less powerful processor required than for a graphical
 - No device to control pointer eg trackpad, touchscreen
 - Less scope for error when linked to scenario
- Any two answers – 1 mark each.*

(d) **Two** items that the documentation would specify about a procedure are: **2 PS**

- Language name or version type
- Types of parameters
- Order of parameters
- Procedure name
- Parameter passing mechanism
- Description of Procedure Purpose

Any two answers – 1 mark each.

(e) (i) Both these types of testing are necessary because: **2 KU**

- One tests individual sections of code with suitable test data
- The other one tests integration of the modules

Any two answers – 1 mark each.

(ii) **Two** uses that the company would make of this summary are: **2 PS**

- Used to track correction of bugs (1)
- Used during maintenance to inform test cases already applied (1)
- Identify additional testing required (1)
- Identify whether additional developments are required

Any two answers – 1 mark each.

2. (a) A stack is a data structure where items can only be added to the top/ tail (1) **2 KU**

OR

removed from the top/tail (1).
LIFO gains 1 only

(b) When the stack has only one item $top = 0$, when a pop takes place this will reduce the top by 1 (1), giving the value -1 (1) **2 PS**

(c) Pushing to a full stack (1), popping from an empty stack (1) **2 PS**
OR stack underflow (1), stack overflow (1)

3. (a) (i) The purpose of the dummy value **3 KU**
- Used to replace (1)
 - The largest value (1)
 - In the unsorted list (1) or
 - On each pass through the list or
 - So that the new largest value can be identified

Maximum of 3

- (ii) Range of possible marks is 0 to 100 or dummy value is out of range (1) **2 PS**
 Because on each pass we are identifying largest so must be a low value for descending sort (1)

(iii)

| | | | | | | |
|----------|----|----|----|----|----|----|
| Index | 0 | 1 | 2 | 3 | 4 | 5 |
| Unsorted | 80 | -1 | -1 | 88 | 79 | 75 |
| Sorted | 96 | 89 | 0 | 0 | 0 | 0 |

2 PS

1 mark for each line sorted or unsorted

- (b) (i) Compares adjacent items (1), if out of order swaps them (1), repeats until there are no more swaps (1) **3 KU**
- (ii) **2 KU**
- Bubble sort uses less memory (1)
 - May perform fewer comparisons because it would terminate when no more swaps are required (1)

OR

- Because the list is partially sorted

4. (a) Dim rainfall (11,4) as integer **3 PS**

OR

Dim rainfall (12,5) as integer

1 mark type, 1 mark each correct index used consistently

- (b) frequency=0 **6 PS**
 for outerloops=1 to 12
 for innerloop=1 to 5
 if rainfall(outerloop, innerloop)>60 then
 frequency=frequency +1
 next innerloop
 next outerloop

1 init, 1 outer loop, 1 inner loop, 1 for if with variable and comparison with 60, 1 for two indices, 1 increment.

- Marks**
5. (a) lower=0, upper=6, middle=3 (1) but 42>25 so discard lower half (1) **6 PS**
 lower=4 (1), upper=6, middle=5 (1) but 42 is not >42 discard upper
 half (1) so upper=4 (1)
 loop terminates since list [5] is 42 and is equal to search_item 42 (1)
 message search item found at 5.
- (b) If line (1) change the > to < (1) **2 PS**
6. (a) (i)
 - Both have a range of data types
 - Both have similar control structures**2 KU**
- Any two answers – 1 mark each*
- (ii) Two advantages of an object-oriented language when compared to a low level language are: **2 PS**
- Range of data types
 - Range of control structures with meaningful names to control flow of execution
 - Access to a range of arithmetical and mathematical functions
- Any two answers – 1 mark each*
- (iii) One advantage of a low level language when compared to an object-oriented language is: **1 PS**
- Optimization of code for faster execution/more efficient code.
- (b) (i) Create a class for the enemies (1) and you can create as many instances of this class as game play requires (1). **2 PS**
- (ii) Create a new subclass for a level two enemy (1) which inherits all of the properties and methods of the superclass (1) already defined for the level one enemy. **2 PS**
- OR**
- Only need to code the new features.

[END OF SECTION I]

SECTION II – Part A – Artificial Intelligence

Marks

7 (a) (i) [(), (), (4, 3, 2, 1)]

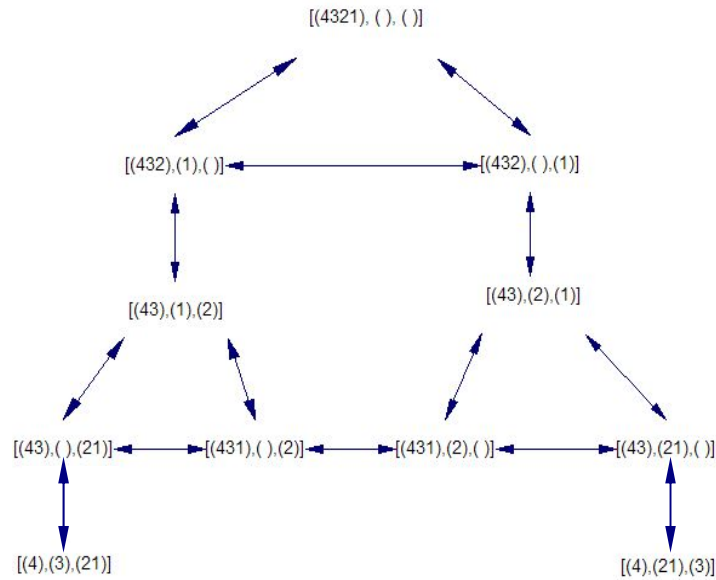
1 PS

(ii) [(4, 3, 2), (1), ()]
[(4, 3, 2), (), (1)]

2 PS

(b) (i)

4 PS



4 marks for a completely correct graph.

Partial marks as follows:

- nodes: 2 marks for 10-11, 1 mark for 8-9
- links: 2 marks for 13-14, 1 mark for 11-12, 0 marks if arrows are single direction, or there are no cross-links.

(ii) Any **two** from:

2 KU

- 2-way arrows
- cross-linking or no repeated nodes
- no clear start and end point

- 8 (a) (i) Combinatorial explosion/large number of branches/large trees **1 KU**
- (ii) Any example such as chess; give the mark for **description** that shows clearly that the problem will suffer from combinatorial explosion. **1 PS**
- (b) 3. C is selected from the agenda, as it has the highest value (1). C is not a goal state, so it is removed (1) and its successor (G) is added to the agenda, which is now [B, H, J, G] (1) **5 PS**
4. G is selected from the agenda, as it has the highest value. (1) G is a goal state, so the search terminates (1).
- (c) (i) Hill-climbing can get stuck (eg at node D) if there are no higher successors **1 KU**
- (ii) Best-first can back-track or maintains agenda and follow another branch **1 KU**

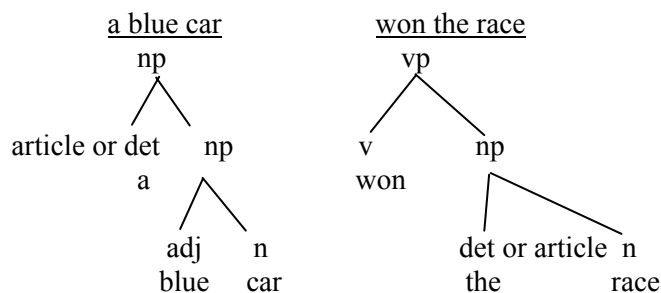
- 9 (a) (i) member(X,[Head|Tail]) IF member(X, Tail) (1 mark for each part of rule) **2 KU**
- (ii) Tries to match 1st clause: compares blue with a (head of list) – fails (1)
 Applies 2nd clause: generates sub-goal member (blue, [blue car, won, the, race] (1)
 tries to match 1st clause to sub-goal; compares blue with blue – succeeds (1)

Answer must show some idea of being a list

- (b) (i) Checking that a sentence is grammatically correct **1 KU**
- (ii) Example such as “I saw her duck”, where “duck” could be a noun or a verb. **2 KU**

1 mark for example, 1 mark for explanation (must be syntactic)

- (iii) **3 PS**

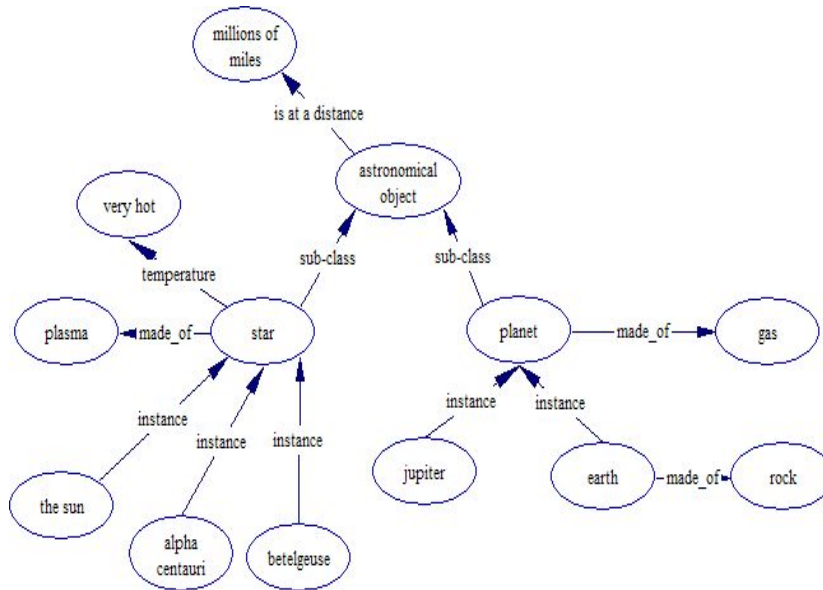


(1 for initial split into np+vp; 1 mark for splitting the np; 1 mark for splitting the vp)

10 (a)

Marks

4 PS



2 mark for all nodes (allow 1 mark if 11-12 nodes); 1 mark for all links correctly named; 1 mark for all links shown with correct direction arrows

(b) (i) There is only one sun, so it is an instance of star (1), but there are many different stars, so star is a sub-class (1) **2 PS**

(ii) The attribute has this value, which is inherited (1) by sub-classes and instances, unless over-written by an actual value (1) **2 KU**

(c) (i) `is_at_distance(astronomical_object, millions_of_miles).` **3 PS**

`sub_class(planet, astronomical_object).`
`sub_class(star, astronomical_object).`

`temperature(star, very_hot).`
`made_of(star, plasma).`
`made_of(planet, gas).`

`instance(the_sun, star).`
`instance(alpha_centauri, star).`
`instance(betelgeuse, star).`
`instance(jupiter, planet).`
`instance(earth, planet).`

`made_of(earth, rock).`

1 mark for completeness (12 clauses); 1 mark for correct structure for each clause; 1 mark for valid syntax eg using lower case for arguments, underscores, full stops

(ii) There is no matching clause, so solution is false or can only be deducted if an inheritance rule is added. **1 PS**

(iii) `made_of(X, Y) if instance(X, Z) and made_of(Z, Y)` **2 PS**
`temperature(X, Y) if instance(X, Z) and temperature(Z, Y)`

- (d) (i) analysis **1 KU**
(ii) eg how many stars/planets are to be included **1 PS**
- 11** (a) (i) IF loss of appetite AND dull feathers THEN cause is CSP-3 virus CF0.9 or CF 90 **3 PS**
IF loss of appetite AND dull feathers THEN cause is shortage of vitamin B25 virus CF0.1 or CF 10
1 for each rule + 1 for valid CF's
- (ii) Cause is CSP-3 virus CF0.9 IF loss of appetite AND dull feathers (1) **1 PS**
Syntax (form) is different, but semantics (meaning) is the same **2 KU**
1 for defining syntax and semantics, 1 for relating to example
- (b) Backward chaining – begins with hypothesis, generates sub-goals, back-tracks to find out if it is true **4 KU**
Forward chaining – gathers facts, uses rules to generate more facts, until a conclusion is reached
For each method, 1 for start and end, 1 for mechanism
- 12** (a) Is it hollow or solid? (or other valid) **1 PS**
- (b) It is not trihedral/some edges are curved **1 KU**
- (c) Rote learning – must learn each individual cylinder it sees (1) **3 PS**
Learning by example – can make generalisations from given examples (1)
So learning by example is more appropriate (1)

[END OF SECTION II – Part A]

SECTION II – Part B – Computer Architecture

| | <i>Marks</i> |
|---|--------------|
| 13. Any three of: <ul style="list-style-type: none">• Each processor has access to its own local memory or cache• All processors can access a main (global) memory by a system wide bus• The processors are pipelined – the results from one processor can become the input for another processor• As well as the system bus, there may be local pathways connecting groups of processors into clusters, and other pathways connecting clusters• Communication using packet switching technology, as on a large network | 3 KU |
| 14. (a) (i) 00100100 | 1 PS |
| (ii) It doubled its value | 1 PS |
| (b) (i) CMP(15) | 1 PS |
| (ii) JGT(37) | 1 PS |
| (c) It could mean that the pipeline might have to be flushed and re-filled with another set of instructions thus delaying processing | 2 PS |
| 15. (a) Single Instruction Multiple Data instruction which performs a single operation (1) on multiple places of data (1) (no marks for simply expanding acronym) | 1 KU |
| (b) <ul style="list-style-type: none">• The graphics file data would be divided up and stored in the available registers (1)• The adjustment operation would then be applied to all the contents of each of the registers (1) simultaneously (1) | 3 PS |
| 16. (a) Any four of: <ul style="list-style-type: none">• A small number of consoles will be produced• These consoles will be sent to a variety of independent users• These users will log defects or faults• Feed this back to development team who will make adjustments• The process is iterative until the console is ready for commercial distribution | 4 PS |
| (b) Any three of: <ul style="list-style-type: none">• Large instruction sets• Many complex instructions• Many addressing modes• Implement some high-level languages constructs in machine instruction sets• Fewer general purpose registers | 3 KU |

- (c) Because most instructions involve manipulating data by transferring them between registers, this greatly reduces the number of, slower, accesses to main memory when compared to CISC processors, thus providing the performance gain. **2 KU**
- (d) A RISC processor requires **2 PS**
- A large number of general purpose registers
 - All of the same size
- (e) (i) In CISC-based designs, instructions can vary greatly in length. Some instructions may be able to be executed in a few clock cycles, while others may require 10, 20 or more clock cycles (1). **2 PS**
- For a pipeline to operate smoothly, avoiding delays, instructions need to be of similar length (1).
- (ii) All instructions are 4 bytes long (1) and so there is little or no variation in the number of clock-cycles needed to execute them (1). **2 PS**
- 17. (a) Dependency: **2 PS****
- Instructions 2, 3, 4 are dependent on the result of instruction 1 (and thereafter, on each preceding instruction) (1), and so the pipelines processing instructions 2, 3, and 4 are delayed and cannot be executed in parallel (1).
- (b) Data flow analysis: **4 PS**
- + any three of: a technique in which the processor
- Analyses which instructions are dependent on each others results or data
 - Creates an optimised schedule of instructions
 - Schedules instructions to be executed when ready independent of the original program order
 - Preventing unnecessary delay

Marks

- 18.** (a) Registers, cache, main memory, hard disk, CD-RW **1 KU**
- (b) There is not enough RAM memory (1) and so the software/data is continually being loaded in from the hard disk in blocks (1) **2 PS**
- (c) Greater capacity L2 cache or memory interleaving **1 PS**
- (d) (i) It connects peripherals to the main system bus **1 KU**
- (ii) Answer should refer to the data in the table below, using either of the two versions of the PCI bus **2 KU**

| | Bus width | Clock speed | Data transfer rate |
|-------|-----------|-------------|--------------------|
| PCI | 32 bit | 33 MHz | 132 MBps |
| PCI | 64 bit | 33 MHz | 264 MBps |
| PCI-X | 64 bit | 133 MHz | 1GBps |

1 mark for each difference

- (iii) The greater bus width will increase the amount of data transferred in one cycle from 32 to 64 bits (1). The increase in clock speed will increase the frequency of data transfers (1). **2 PS**
- 19.** (a) (i)
 - The logical view of the files is the user's view of the file structure with the files stored in an orderly hierarchy of directories (1).
 - The physical view of the files is the operating systems record of the actual locations of the data in Mitsuko's files which will be stored on backing storage (1).**2 KU**
- (ii) This enables Mitsuko to organise her files in an orderly fashion (1), helping her locate files (1) and even control access to (1) files (2 of) **2 KU**
- (b) Any **four** of: **4 KU**
- Track the movements of the mouse
 - Calculate the position of the pointer
 - Respond to mouse clicks
 - Interpret the data on mouse clicks and pointer and then load and execute the relevant instructions
 - Refresh screen displays as icons are moved

- (c) (i) • Each file is stored in a series of neighbouring clusters **2 KU**
• The operating system then keeps a directory of where each file is stored

- (ii) The free space is split up and scattered across the disc surface, rather than in usable contiguous blocks, causing fragmentation. **1 KU**

OR

If disk space is fragmented the file may not fit into the available contiguous space, despite the fact that the total space available appears adequate.

- (iii) **Linked allocation** **2 KU**

File spread across a range of scattered clusters – 0 marks

The system must maintain a directory of where each file starts (1). Each cluster has a pointer to the next (1)

OR

Indexed allocation

File stored in non adjacent clusters (0 marks) and all the pointers (1) for a file are stored together in an index block (1)

- (iv) **Linked:** **2 KU**
• Data can be stored in any available space throughout the disk avoiding fragmentation and, using pointers at the end of each cluster, files can be easily extended

OR

Indexed:

- This means data can be stored in any available space throughout the disk avoiding fragmentation
- By adding additional pointers to the index block, files can easily be extended

- (d) (i) Embedding the graphics could make the size of the files too large to be handled by e-mail **1 PS**

- (ii) Uploading to a website **1 PS**

Compression

Any valid answer

[END OF SECTION II – Part B]

SECTION II – Part C – Computer Networking

Marks

20. (a) (i) Fibre optic is the most suitable transmission medium for this purpose because **3 PS**

- Fastest transmission rate
- Longest unrepeated segment length
- Most secure
- Least susceptible to interference

Any 3 – 1 mark for each comparative statement

(ii) **2 PS**

- UTP cable has improved from cat 5/5e at 100Mbps to CAT 6 at 1 Gbps (1)
- The increase in bandwidth for Wi-Fi eg 802.11n
- Increase in range of Wi-Fi eg 802.11n
- The improvement in security by the replacement of WEP by WPA

} Any 1

Answers should refer to standards or specific values

(b) Advantages: 2 KU

- All hardware and software bought from Netwile will be compatible
- All hardware and software can be supported by one company
- Network may be more secure than if using open protocols

Disadvantages:

- Completely dependant on a single company for support
- Netwile pricing structure may change and the system becomes too expensive
- The price of support depends on one company
- May be difficult to find in-house technicians with the required experience
- Existing network technicians may have to be retrained
- Data transfer between clients/customers etc may not be possible or may be limited
- Existing support in free downloads and forums will be of no use

Must give any 1 advantage and 1 disadvantage.

(c) System would be installed in intended customers workplace for use in a real situation (1 mark). **2 PS**

The clients feedback the details of all problems as they occur (1 mark).

21. (a) Calculate how long it should take to transfer the file **3 PS**

Bits transmitted = $162 * 1024 * 1024 * 8 = 1,358,954,496$ (1 mark for amount in bits)

Bits per second = $54 * 1,000,000$ (1 mark for use of 802.11g rate)

Time taken = 25.165824 seconds (1 mark for dividing amount by rate)

1 mark for each line or equivalent

(b) **Two** reasons why this 802.11g router might drop packets: **2 PS**

- The distance might be sufficient to cause dropped packets (so transfer rate will fall)
- Interference/blockage from walls may cause dropped packets
- Other home electrical devices may cause interference and cause dropped packets

Any 2 – 1 mark for each

(c) The wireless router would need this piece of information because, the MAC address is often used as the basis for user authentication. **1 PS**

22. (a) (i) Get (1 mark) **1 KU**

(ii) 200 OK, 404 Not Found **2 KU**

(b) `Revision` **3 PS**
use of `<a>` tag (1 mark)
use of href (1 mark)
All syntax correct (1 mark)

(c) **Two** reasons for using each of the following intermediates are: **2 KU**
(i) **Gateway:**

- Protocol conversion from the network to the Internet
- Enhance security by having a firewall that restricts external access to the internal network

1 mark each

(ii) **Proxy server:** **2 KU**

- Conserves IP addresses by allowing a network to have multiple private IP addresses and only one public address
- Gives a single point of connection to the Internet which allows for filtering of access
- Caching web pages locally to speed up access

1 mark each

(d) • Download and install a plug-in **1 PS**

OR

• Install flash

OR

• Install shockwave

1 mark

(e) (i) The role of the MIME protocol in sending and receiving e-mail attachments is **4 KU**

• Translates the media file (1 mark) into plain text (1 mark)

• Adds header information to the e-mail (1 mark) which specifies the original content type and transfer encoding.

• On the receiving side MIME is responsible for converting the file back to its original format (1 mark)

(ii) The steps the sender of an e-mail should take to ensure that the recipient can be certain it originated from the source given **and** that the contents have not been altered are **4 PS**

• The sender needs (to purchase) encryption software that will allow him to create a public and private key (1)

• The sender gives a copy of the public key to the intended recipient. The sender uses the private key (1) to create a message digest that is based on the message content (1)

• The receiver uses the public key (1) to decrypt the message digest

• The recipient also creates a message digest and compares it with the one sent (1)

Any 4 of the 5

| | | <i>Marks</i> |
|------------|---|---|
| 23 | <p>(a) • May be used to create SECURE sections (1 mark) within one large network</p> <p>• A relatively large number of nodes (1 mark) causing too many collisions and limiting bandwidth available (1 mark)</p> <p>Any 2 of the 3 marks</p> <p>(b) • Allows varying sizes of networks to be allocated rather than the fixed A, B or classes C (1 mark) which has decreased the amount of wasted/redundant addresses (1 mark)</p> <p>• Allows for a hierarchical routing system (1 mark) which has helped keep routing tables to a manageable size (1 mark)</p> <p>(c) • The /22 means that 10 bits identify the host</p> <p>• Therefore $2^{10} = 1024$ address</p> <p>• All 0's and all 1's not allowed therefore = 1022 addresses</p> <p><i>1 mark each for point</i></p> <p>(d) Network</p> | <p>2 PS</p> <p>4 KU</p> <p>3 PS</p> <p>1 KU</p> |
| 24. | <p>(a) (i) Friday, full, week 1 + Monday week 2 incremental + Tuesday week 2 incremental</p> <p><i>2 marks for all 3, 1 mark for 2 correct</i></p> <p>(ii) Friday, full week 1 + Friday week 3 differential + Monday week 4 incremental</p> <p>(b) As the crash on the Tuesday of week 4 happened much later in the day than the first example it is likely that more data will be lost</p> <p>(c) Two aspects of a good user interface</p> <ul style="list-style-type: none"> • Easily accessible online help • Multiple user levels • Clear labelled dialogue boxes <p><i>Any 2 – 1 mark each</i></p> | <p>2 PS</p> <p>2 PS</p> <p>1 PS</p> <p>2 KU</p> |

25. (a) (i) Smurf **1 PS**

OR

Ping of death

(ii) Smurf: a normal ping packet contains the IP address of the sending computer (1), whilst the altered packet replaces this with the IP address of the target of the DoS attack (1) **2 PS**

Ping of Death: the normal size of a ping request is 64 bytes (1). The ping of death packet is greater than the maximum size of 65, 535 bytes (1) and may cause a system crash

(iii)

- The ping command can be a useful diagnostic tool and may be legitimately used
- Blocking ICMP commands will also stop computers behind the firewall from pinging computers outside the firewall
- There are other ICMP commands that you may wish to allow (eg traceroute)
- ICMP commands can be used by some network devices to gather information

2 PS

Any 2 – 1 mark each

(b) Two reasons for denial of services are: **4 PS**

A brief description of a DNS attack or DoS attack on another part of the network connection (up to 2 marks per description) eg

- DNS “poisoning” could have occurred and therefore clients trying to use its services are being directed elsewhere.
- A gateway which is used to access the server may have suffered a DoS attack and may not be able to forward the requests.
- The router which the server connects to may have been flooded by traffic and be unable to work normally.
- Infrastructure failure eg broken switch or cable.

[END OF SECTION II – Part C]

[END OF MARKING INSTRUCTIONS]