



2009 Computing

Advanced Higher

Finalised Marking Instructions

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SECTION I – Software Development & Developing a Software Solution

		<i>Marks</i>
1.	(a) Project proposal	1 KU
	(b) (i) Legal feasibility	1 KU
	(ii) The removal of content from websites could be hacking (1) and any removal of content would have to be done in a way that does not contravene the Act (1). Might own the content (1) and so are not contravening the Act (1).	2 PS
	(c) (i) <ul style="list-style-type: none">Analysed to identify the features (1) of the software that must be present in the design (1).Used to validate the design (1) by checking that the design satisfies the functional requirements in the ORD (1).Used to design the features of the user interface (1) that have been defined in the ORD (1). Any 2 bullet points	4 PS
	(ii) <ul style="list-style-type: none">Implementation to check that the functional requirements are met by the software.Testing – to verify that all functions of the software have been systematically tested.Evaluation to check that software is fit for purpose/correct by meeting ORD.No marks for naming the stage.	1 PS
	(iii) <ul style="list-style-type: none">Suitable data types.Suitable control structures.Ease of creation of interface.Contains an extensive module library.Quality of debugging features.Any other valid – do not accept programmers' expertise.	2 PS
	(d) <ul style="list-style-type: none">Automatic generation of code from design languages.Automatic data modelling/schema.Automatic user documentation.	2 KU
	(e) (i) <ul style="list-style-type: none">Module testing is the testing of (a collation of) dependent components with a range of test data.	1 KU
	(ii) <ul style="list-style-type: none">Acceptance/beta testing – clients testing the software on their systems. Accept systems testing. 1 mark for name/1 mark for description	2 KU

		<i>Marks</i>
2.	<p>(a) • Queues – items added at one end and removed from the other (1) do not accept FIFO.</p> <p>• Stack – items are added and removed from the same end (1) do not accept LIFO.</p> <p>(b) (i) • The URL at the top of the stack is popped from the stack and loaded (1). • The stack pointer is decreased by one (1).</p> <p>(ii) • The items are not deleted from the stack (1) • so the stack pointer would be increased (1) and • that URL loaded (1). For 2 marks answer should include second bullet point and either of the other 2 bullet points.</p> <p>(iii) • Push to full stack or stack overflow (1). • Pop from empty stack or stack underflow (1).</p>	<p>2 KU</p> <p>2 PS</p> <p>2 PS</p> <p>2 KU</p>
3.	<p>(a) (i) Type patientrec Phone:string Name:string Glucose:integer Cholesterol:integer End type</p> <p>(1) Type/end type or similar, (1) for four fields with suitable names, (1) for correct data types.</p> <p>(ii) Dim patients (3000) as patientrec (1) for 1D array, (1) for 3000, (1) for matching data type to (i)</p> <p>(b) Open (1) Loop 3000 times (1, must have end) If patients().glucose<75 and patients().cholesterol>200 then 1 for if/end if, 1 for complex condition() Write/print patient().mobile, patient().name 1 write, 1 use of correct variables() End if End loop Close</p> <p>(c) Breakpoints – stopping execution at a predefined point. Inspect(watch) variable contents. Step through the program to check flow of execution. Do not accept manual methods.</p>	<p>3 PS</p> <p>3 PS</p> <p>6 PS</p> <p>1 KU</p>

			<i>Marks</i>
4.	(a)	(i) Bubble	1 KU
		(ii) Ascending order	1 PS
		(iii) It <u>compares two adjacent items (1)</u> to determine if they are out of order and need exchanged (1).	2 PS
	(iv)	A <ul style="list-style-type: none"> • Swap is changed to true every time a swap takes place (1). • Because if no swaps occur, the list is sorted (1). 	2 PS
		B This variable will be used to terminate the conditional loop (1) (not shown in the section of code). OR The variable is set to false before the loop shown (1).	1 PS
	(b)	(i) To locate errors in code (1) by stepping through the code recording changes to variable (1).	2 KU
		(ii) A = 30, B = 25, C = 30, D = true (should counter change at line 8).	4 PS
5.	(a)	Checks each item in the list in order/one after the other/from start until a match is found.	1 KU
	(b)	(i) 2	1 PS
		(ii) A Lower (1)=middle+1 (1)	2 PS
		B Upper(1)=middle-1 (1)	2 PS
6.	(a)	Low level languages stored data in hex/binary of various sizes eg byte, db, word (1). Low level languages have a limited set of arithmetical and logical operations available on the data through instructions such as SHL. High level languages have a wide range of arithmetic available to a data type. High level languages have a wide range of data types (1). High level languages allow the definition of complex/abstract/structured data types (1) based on the other types. Any other suitable.	2 KU
	(b)	<ul style="list-style-type: none"> • Statements involving a more natural form of language (1). • Requiring less programming effort. • Usually found in the manipulation of databases using languages such as SQL or scripting. • Much less stringent syntax rules. • Any other suitable. 	2 KU

[END OF SECTION I]

SECTION II – Part A – Artificial Intelligence

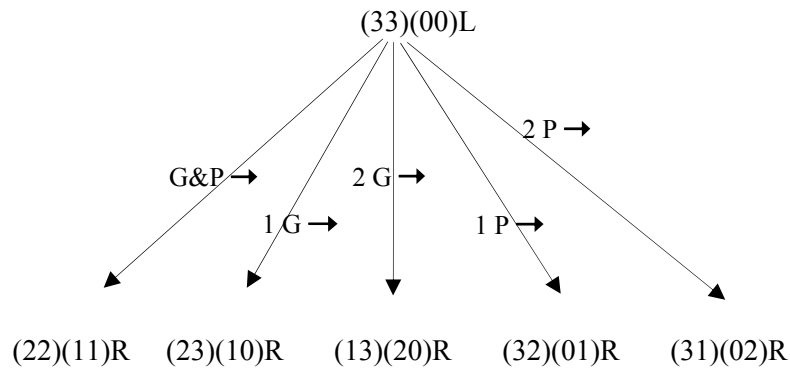
Marks

7. (a) [(0,0),(3,3),R]

1 PS

(b) (i)

3 PS

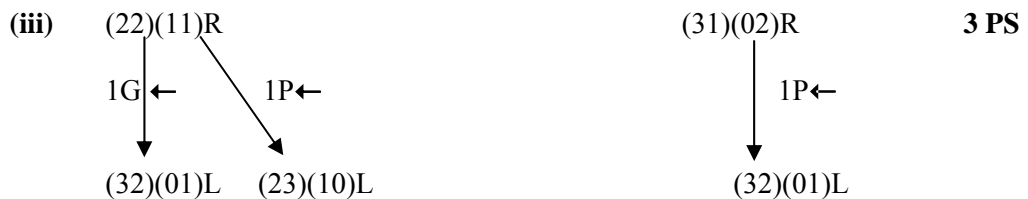


1 mark for appropriate labelling of the 5 branches.
 2 marks for correct representation of all 5 resultant nodes.
 (Allow 1 mark for 3-4 correct nodes, 0 marks for less than 3 correct nodes.)

(ii) (23)(10)R guards on L outnumbered (or, only possible move returns to start state) **3 PS**

(13)(20)R guards on L outnumbered

(32)(01)R only possible move returns to start state



1 mark for each correctly labelled branch and resultant state.
 Do not penalise additional branches.

8. (a) until current_state=goal_state or **no change in current state** **1 KU**

(b) (i) Change highest to lowest **2 PS**
 Change > into <

(ii) Best-first **1 KU**

(c) (i) Directs search towards more promising states (1).
 So less time/memory requirements (1). **2 KU**

(ii) More complex to program (1).
 Requires calculation of evaluation function (1). **2 KU**

9. (a) Ring 2 is on top of ring 1 (which is smaller). **1 PS**

(b) (i) move(1,A,B)
move(1,A,C) **2 PS**

(ii)

- Move(1,A,B) etc are in the same format as a Prolog clause.
- Allows rules to be written corresponding to moves.
- Allows recursive operation of rules.
- In-built depth-first search mechanism.

 (Any 2 of these reasons.) **2 PS**

10. (a) (i) **4 PS**

Takeaway	
subclass:	eating place
food-type:	fast food
licensed:	*no

Sit-in	
subclass:	eating place
food-type:	full meals
licensed:	yes
has:	tables & chairs

Tom's Tower	
instance:	takeaway

The Boat	
instance:	sit-in
licenced	no

Note: answers may also include slots filled by inheritance – do not penalise these. 1 mark for each complete frame.

(ii) Not licensed or fast food (1), inherited from takeaway (1). **2 PS**

(b) Subclass represents a group, instance is a single example. **2 KU**

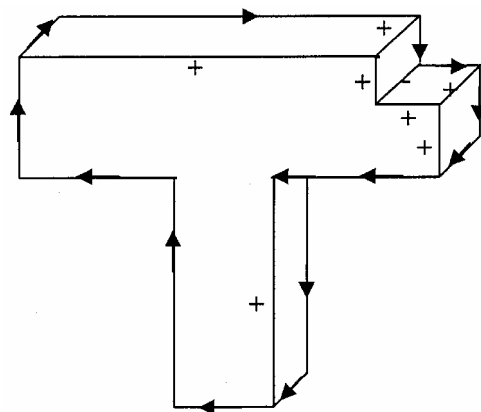
(c) (i) [eastern_star, chevy_nova, rudha_reidh]. **2 KU**

(ii) Using clause 1: is eastern_star the head of the list? fails
Using clause 2: generates subgoal: is eastern a member of the tail?
Using clause 1: is eastern_star the head of the tail? yes
Recursive, as the second clause/rule calls itself. **4 PS**

- | | | <i>Marks</i> |
|-----|---|-----------------|
| 11. | (a) (i) (From firing of Rule 3) “ symptom is fever ”. | 1 PS |
| | (ii) (Rule 1 can now fire) adding “ hospital care is required ” to working memory.
(Rule 2 can now fire) adding “ diagnosis may be influenza ” to working memory. | 2 PS |
| | (b) To decide which rule to fire next when there is more than 1 possibility. | 1 KU |
| | (c) (i) rule 2: IF patient has fever AND patient has pains in stomach and legs THEN diagnosis may be influenza CF50 (or 0.5) | 1 PS |
| | (ii) CF of conclusion (rule 1) is 0.9
CF of 1 st condition is 0.75 (rule 3)
CF of 2 nd condition is 1.0 (it is a fact) (1 mark) | |
| | So CF is $0.9 \times \min(1.0 \text{ and } 0.75) = 0.9 \times 0.75 = 0.675$ (or 67.5%)
(1 mark) | 2 PS |
| | (d) (i) Any 2 of economic, legal, time or technical – description in context | 2 KU/Int |
| | (ii) Semantic (1) – extracting meaning (1)
Pragmatic (1) – clarifying meaning by reference to context (1) | 4 KU |
| | (iii) NLU requires complex programming and storage of large amounts of data, (1) so requires large amounts of RAM, which has only recently become affordable (1) for commercial applications. | 2 PS/Int |

12. (a) Inductive learning = learning by example. **3 PS**
 Show examples of valid arches (eg 1, 2) – generalise concept from these.
 Show examples of non-arches (eg 3) – use this to refine concept.

- (b) (i) **3 PS**



1 mark for all arrows
 1 mark for all + symbols
 1 mark for the - symbol
 (do not penalise if the arrow at top R of upright is missing)

	<i>Marks</i>
(ii) First pass may not be able to define all vertices, so a second pass (or more) may be required.	1 KU
(iii) Any non-trihedral shape (must be justified for the mark).	1 KU

[END OF SECTION II – Part A]

SECTION II – Part B – Computer Architecture

		<i>Marks</i>
13.	(a) A small number of simple instructions that mostly have the same length/format; register orientated instructions. A minimal number of addressing modes.	3 KU
	(b) The memory address register (MAR) holds the address of the location in memory which the processor is accessing to write to or read from. The Instruction Register (IR) holds the instruction currently being executed.	2 KU
	(c) Having so many general purpose registers available means that the processor can manipulate data stored in the high speed registers and so cut down the number of slower accesses to main memory.	2 PS
	(d) Op-code describes the operation to be performed on the data. Operand contains information about the source or the destination of the data on which the operation is to be performed, or the data itself.	2 KU
	(e) Having instructions of the same length because having instructions of different lengths cause delays in the operation of a pipeline since instructions of different lengths need different numbers of clock cycles to be executed. This problem would be compounded in a superscalar processor since it uses multiple pipelines.	4 PS
	(f) <ul style="list-style-type: none">• The processor uses a branch table in cache memory• to record whether or not the branch was “taken” previously,• use this table to predict which branch will be processed then fetches the relevant instructions.	3 KU
	(g) The brightness of an image could be increased by using a SIMD instruction to perform the same operation, eg incrementing a value, on the set of values that represents the brightness of each pixel in the image. This improves performance because it avoids the need to repeatedly load and decode the instruction thus making less demands of the processor’s time.	3 PS
14.	(a) Memory is split up into several independent RAM chips. Data is written/read to/from these chips concurrently minimising wait status and so saving time.	3 KU
	(b) When interleaving is used to read from memory it can read instructions which may need processing before the next item of data can be read thus leading to delays. However, the dedicated video RAM contains only video file data and does not hold instructions which can cause delays.	3 PS

		<i>Marks</i>
15.	<p>(a) Static RAM chips because of their fast access speeds.</p> <p>(b) The increased capacity of Level 1 and Level 2 cache on the McI09 will increase the amount of data and instructions held in cache leading to a higher cache hit rate (more chance the processor will find the data/instruction in cache) and thus decrease the latency caused by slower accesses to main memory.</p> <p>The fact that level 2 cache on the McI09 is on the processor will lead to an increase in processing speed because the Arbitron04's Level 2 cache is on the motherboard with consequent increased latency caused by slower access times.</p> <p>(c) A DMA controller is attached to the system bus. When the processor requires to make a block data transfer, it sends a command to the DMA controller. The DMA controller (DMAC) then takes over and transfers data between main memory and the I/O module releasing the processor for other tasks.</p>	<p>2 PS</p> <p>4 PS</p> <p>3 PS</p>
16.	<p>(a) Variable memory partitioning is the process of allocating space in memory according to the demands of the processes being stored rather than dividing up the available memory into fixed blocks.</p> <p>(b) Worst fit algorithm allocates the largest space available to an incoming process. This has the effect of leaving larger free areas. Therefore incoming processes are more likely to fit into one block thus limiting fragmentation.</p> <p>(c) (i) The logical view is the user's view of the video file and its place in the directory structure. The physical view is the systems record of the physical location of the data blocks that might make up the file.</p> <p>(ii) 1 mark for 7,2,6 and 2 for 7,2,6,4</p> <p>(iii) Because in contiguous allocation the blocks that make up the file would be stored in adjacent locations. Therefore there would be no need for multiple pointers since a single directory pointer is all that is needed to locate the entire file.</p> <p>(d) Two of: The 'modification' attribute can be used to trace the time the changes were made. The size attribute can be used to detect a virus which has altered a file. Creation attribute can be used to pinpoint when a malicious file was set up.</p> <p>(e) (i) Two of:</p> <ul style="list-style-type: none"> • Providing a standard look and feel for applications • Improving the capacity of programs to communicate and pass data • Simplifying and extending the graphic capabilities of applications • Capability of launching one application inside another. • Any other appropriate answer 	<p>1 KU</p> <p>3 PS</p> <p>2 KU</p> <p>2 PS</p> <p>2 PS</p> <p>2 PS</p> <p>2 KU</p>

- (ii) Providing a standard look and feel for applications: because the operating system provides standard graphical items eg dialogue boxes for printing or saving, this provides the user with continuity in the design of the HCI making it easier to move between applications. **2 PS**

Or

Improving the capacity of programs to communicate and pass data: gives the user the ability to transfer data between applications and eg embed a graphic created in one application inside a document produced by another and so improve productivity.

Or other answer relevant to services provided by the operating system.

- (iii) The task of developing software is simplified since eg the operating system provides a wide range of graphical items such as icons, window frames and dialogue boxes which would otherwise have to be created by the software developer. **2 PS**

Or other relevant to services provided by the operating system.

17. (a) • Use the operating system under normal operational conditions and record any problems or observations. **2 KU**
• Send feedback to the software developers.

- (b) (i) When the user chooses to enter a text command there are few demands on the processor. It has only to read in and interpret the text command. **4 PS**

When the user chooses to click on the icon of the file in the directory structure there are a lot more demands on the processor which has to

- display the icons representing the directory hierarchy
- refresh the screen as directories are opened
- calculate the position of the mouse
- read and interpret mouse clicks.

- (ii) Syntax: the steps involved in calling the system to perform an operation eg moving a printer over an icon and clicking the mouse or typing in a command. **2 PS**

Semantics: the operation performed once the syntax has been correctly entered eg the opening of the file.

[END OF SECTION II – Part B]

SECTION II – Part C – Computing Networking
Answer ALL questions in this part

		<i>Marks</i>
18.	(a) 2^{16} (1 mark), take away 2 (1 mark) or 65,536 (1 mark), 65,534 (2 marks)	2 PS
	(b) (i) The geographical split of buildings makes an obvious case for subnetting. Network congestion will be greater on a single network than on 9 subnetworks. Increased security by limiting access to particular subnets. 1 mark for suitable reason and second for making a clear link to scenario.	2 PS
	(ii) 10 bits required to identify 1024 different hosts (1 mark) Therefore 11111111.11111111.11111100.00000000 (1 mark) Therefore 255.255.252.0 (1 mark) 3 marks if correct answer is given.	3 PS
	(iii) 64 If incorrect mask given in (ii) then number of subnets may be correct.	1 PS
	(c) (i) With no clear way to exchange keys securely the public key method is better.	1 PS
	(ii) Both have to install asymmetric encryption software onto their system. Generate a public and a private key. Send the recipient a copy of the public key (or publish the public key). Use the recipient's public key to encrypt the files. Decrypt the files using the recipient's private key. 1 mark each for any 4 of above.	4 KU
	(iii) Message authentication (digital signature). Longer encryption key. Establishment of a VPN between establishments. Any valid extra security step (1 mark) properly described (1 mark).	2 PS
	(d) (i) DNS poisoning; attacked the university's DNS server and corrupted the entry for the home page.	2 PS
	(ii) Buffer overflow attacks; SYN attack; Teardrop attack; Smurf Attack. Any 1 for a mark.	1 KU
	(iii) A – full C – incremental D – incremental	3 PS

Marks

- 19. (a) (i)** It allows dialup modems to transmit IP packets (or network level packets) (1 mark) across analogue telephone wires (1 mark). **2 KU**
- (ii)** Data Link layer **1 KU**
- (b)** Allows IP address notification (DHCP).
Passwords not transmitted as plain text.
Data compression.
Connection monitoring.
Use encapsulation to allow multiple network protocols (not just TCP/IP).
Any 3 points for 1 mark each. **3 KU**
- (c) (i)** Recipient may not be online.
Recipient may not have a public IP address.
Recipient may not be accessible using DNS.
Allows recipient to check e-mail from any location.
1 mark each for any 2. **2 PS**
- (ii)** hello clientdomain.com **3 PS**
250 sender ok
Quit
- (d)** **3 KU**

OSI	TCP/IP
Application	Application
Presentation	
Session	
Transport	Transport
Network	Internet
DataLink	Network
Physical	

1 mark for OSI layers, 1 mark for TCP/IP layers and 1 mark for correct mapping.

			<i>Marks</i>
20.	(a)	(i) Plug-ins <h1>Plug-ins</h1>	2 PS
		(ii) Adobe Acrobat Reader 2 marks	2 PS
	(b)	(i) Display multimedia elements: Flash, Shockwave Display streaming audio/video: Quicktime, RealPlayer, Windows MediaPlayer (1 mark for each type and 1 mark for a named example of each)	4 KU
		(ii) A wide variety of answers are possible but must clearly relate to the added functionality afforded by plug-ins and show a direct link to an appropriate implication. Eg the extensive time being spent on watching video or playing flash style games. An increasing use of interactive web pages in education, the spread of social websites where videos are shared. The growth of the market for streaming video across the Internet. The capture of video on phones and displaying it on some sites is a good example. School bullying online.	4 PS
21.	(a)	(i) The quality would be poor; the on-screen imaging relatively small; a very limited number of participants; poor synchronisation of sound and video.	2 PS
		(ii) Need for matching codecs, probably as separate hardware or embedded in dedicated video conferencing video systems with large screens; more complex video conferencing software which allows for a number of simultaneous users, perhaps a dedicated server and a minimum of 256 Kbps upload and download speed.	2 PS
	(b)	(i) Low power usage and ability to transmit through most materials. Greater precision in positioning.	2 PS
		(ii) 5 Ghz and 54Mbps	2 KU
		(iii) 802.11 family	1 PS
	(c)	(i) 1 mark for identifying a component as a sub-part of a module. 1 mark for appropriate example eg component – validating received data, module reading basket of goods OR component – adding price of good to bill, module – processing goods read.	2 PS
		(ii) Some stores (1 mark for testing onsite) would be required to run the wireless system could run in parallel with a conventional POS system (bar codes) and the customer transactions compared. (1 mark for recognition that system could only be trusted after a test period.)	2 PS

[END OF SECTION II – Part C]

[END OF MARKING INSTRUCTIONS]