X206/13/01

NATIONAL QUALIFICATIONS 2014

FRIDAY, 23 MAY
9.00 AM – 11.30 AM

COMPUTING
ADVANCED HIGHER

Attempt **all** questions in Section I.

Attempt **one** sub-section of Section II.

For the sub-section chosen, attempt **all** questions.

Read all questions carefully.

Do not write on the question paper.

Write as neatly as possible.

Each section should be answered in a separate answer book.

©

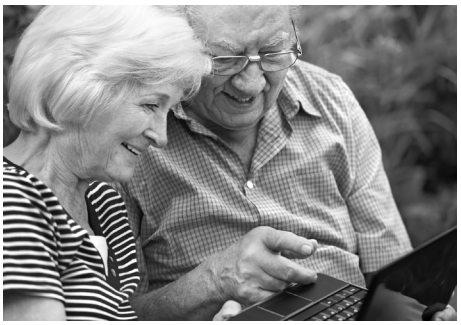
SECTION I

Marks

Software Development & Developing a Software Solution

Answer ALL questions in this section.

1. The Simply Amazing Retired People group has recently trained all its members in the use of the Internet and e-mail. Traditionally the club had a notice board where members could pin up postcard-size advertisements about objects for sale, publicise entertainment events, promote exercise activities for retired people and so on. The group now has an electronic version of this notice board on their website so that members can upload their own notices and include advertising videos for events.



The group employed a software development company to create the electronic noticeboard.

(*a*) The *scope and boundaries* for the electronic noticeboard were clearly identified by the development company.

Describe the difference between the scope and the boundaries of a project. **2**

(*b*) As part of the development process, the developers identified *sub-tasks* for the project. Explain why it was necessary to do this. **2**

(*c*) Describe **two** issues related to legal feasibility that the development company needed to consider before proceeding with the development of the electronic noticeboard. **2**

(*d*) The website is used by retired people, some of whom may have vision impairment.

(i) Describe **two** features of the user interface that would have been designed so that visually impaired group members could access the electronic noticeboard. **2**

(ii) Identify **one** other impairment that some users may have and explain how the user interface could allow full access to the site for users with that difficulty. **2**

(*e*) The developers used *CASE tools*. State **two** features of CASE tools which will assist the development process. **2**

1. (continued)

(*f*) State **one** reason why the development company recruited some group members to be part of their beta testing team. **1**

(*g*) The software uses a *binary search* to check usernames.

(i) State what needs to be true about the list of usernames in order that the binary search gives correct results. **1**

(ii) Use pseudocode to explain how the binary search routine would check that the entered username is present in the list. **3**

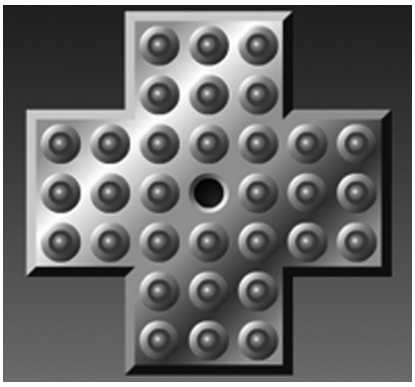
(*h*) The Simply Amazing Retired People group are pleased with how well their members are using their website. They now have some maintenance that they would like done to their site so they get back in touch with the design company.

Describe **two** examples of what they might ask the company to do. **2**

[Turn over

2. The goal of the game Peg Solitaire is to remove pegs from the board by jumping over one peg with another. A peg can only jump over one adjacent peg into an empty location. The peg 'jumped over' is removed from the board. Only horizontal and vertical jumps are allowed. The game is over when there are no more jumps possible. You win the game by leaving only the one peg in the centre of the board.

The initial configuration of the pegs is :



Cameron is learning to program and decides to try to write a computerised version of the game. The gameboard can be represented by a 2D array of characters, identified as **board**, with 7 rows and 7 columns. Each corner block of 2 by 2 locations is unused in the game. The above board can be represented by :

Unoccupied locations denoted by "0"

Occupied locations denoted by "1"

Z	Z	1	1	1	Z	Z
Z	Z	1	1	1	Z	Z
1	1	1	1	1	1	1
1	1	1	0	1	1	1
1	1	1	1	1	1	1
Z	Z	1	1	1	Z	Z
Z	Z	1	1	1	Z	Z

This location is identified by **board(1,3)**

Out of bounds locations denoted by "Z"

and the winning state by:

Z	Z	0	0	0	Z	Z
Z	Z	0	0	0	Z	Z
0	0	0	0	0	0	0
0	0	0	1	0	0	0
0	0	0	0	0	0	0
Z	Z	0	0	0	Z	Z
Z	Z	0	0	0	Z	Z

2. (continued)

(*a*) The top left location of the playing area is identified by

board(1,1).

Identify the location of the solitary peg in the middle of the winning state. **1**

(*b*) Part-way through the game, the board is as shown below. The peg to be moved next is identified.

Peg to be moved next

Peg to be jumped over

Destination location

Z	Z	0	1	1	Z	Z
Z	Z	0	1	1	Z	Z
1	1	0	1	0	0	0
1	1	1	0	1	0	1
0	0	0	1	1	1	1
Z	Z	1	1	0	Z	Z
Z	Z	1	1	0	Z	Z

The user moves the peg from its current location to its destination. The program will record this destination position and then check that this is a valid move.

Write down the detailed pseudocode for the conditional statement that validates the move shown. **3**

(*c*) After each move, a check is made to see how many pegs are left.

Use detailed pseudocode to write down the algorithm that will count the number of pegs left on the board. **4**

(*d*) Cameron decides to create a *user-defined module library* and add a 'count pegs' function to it.

Describe **one** other subroutine, specifically relating to this solitaire game, that could be added to the user-defined module library. **1**

[Turn over

3. In a Show Jumping competition, the 55 competitors are timed as they complete each round of jumps. Time penalties are added for each fence that the horse refuses to jump, for each fence knocked down and for going over the time limit for the round.

The following table shows an extract of the data generated by the competition.

Horse name	Entry number	Time for round (seconds)	Time penalty (seconds)	Total
Anna Millie	17	73·2	4·0	77·2
Foster Giant	18	84·1	7·5	91·6
Grainger O'Malley	19	74·0	0	74·0

(*a*) The results for each horse makes use of a *record structure*.

Describe, in detail, a suitable record structure for this data. **3**

(*b*) The *selection sort using two lists* is used to sort the list in ascending order of "total". Describe how a selection sort using two lists works. **3**

(*c*) As each horse completes its round, its record will be added to the bottom of an already sorted list and then resorted. Explain how the fact that the list is already sorted, except for the last record, will affect the efficiency of the selection sort algorithm. **2**

(*d*) A *bubble sort* algorithm could have been used on the list. Compare it with the selection sort in terms of memory usage and number of comparisons. **2**

3. (continued)

(*e*) At the end of the sort, the results are saved to a sequential file. Explain the following terms as applied to the file handling operation necessary to do this:

(i) open **1**

(ii) write **1**

(*f*) As a result of maintenance, the organisers request that records for the horses that exceeded the "time for round" limit of 75 seconds are stored in an additional file.

Use detailed pseudocode to write the algorithm that will write this information to an external file. **4**

(*g*) During the development of this software, the programmers encountered some errors and had to use both *trace tables* and *breakpoints* to help find the sources of the errors.

Explain the terms "trace table" and "breakpoint". **2**

[Turn over

4. In the early days of hand-held calculators, 'Postfix' notation was used to reduce memory access during a calculation and made use of the *stack* to evaluate expressions. Postfix notation avoids the use of brackets.

The arithmetical expression

6 * (4 + 3)

is written in Postfix notation as

6 4 3 + *

and is then processed, left to right, using a stack.

The pseudocode below describes how the expression is evaluated :

```
repeat
        get next element
        if element is a number then
                push element on to stack
        end if
        if element is an operator then
                pop the top element from the stack
                pop the next element from the stack
                carry out the operation defined by the operator
                push the result on to the stack
        end if
until there are no more elements in the input stream
```

At the beginning of the process the stack is empty.

The first element input is a 6 and this is pushed onto the stack.

Index	0	1	2	3	4	5	6	Stack pointer
	6							0

4. (continued)

After the number "4" has been pushed on to the stack, the state of the stack is:

Index	0	1	2	3	4	5	6	Stack pointer
	6	4						1

(*a*) Explain why the "stack pointer" is needed during stack operations. **1**

(*b*) (i) Following the algorithm above, show the state of the stack after the 3 has been pushed on to the stack. **2**

(ii) Show the contents of the stack, and the value of the stack pointer, after the algorithm has run to completion. **2**

(*c*) The algorithm above makes use of the "pop" operation. Use pseudocode to describe the operation to pop a value from the stack. **3**

(*d*) Describe **one** problem that should be checked for when pushing a value onto a stack. **1**

[Turn over

5. A program is being created to process stock details for an online kitchen equipment store. The table below shows details for five of the kettles stocked by the retailer.

Make	Model	Cordless or Stovetop	Guarantee	Capacity	Number in stock
Mybud	Lime-O	Cordless	3 years	1·7 litres	5
Wizard	Sleek Steel	Cordless	3 years	1·1 litres	8
Beau Villa	VG2	Cordless	2 years	1·4 litres	0
Lethe	White magma	Stovetop	1 year	2·1 litres	6
Lethe	Cinnamon bark	Stovetop	1 year	1·6 litres	3

(*a*) Using the data above, show how **classes** and **instances** can be applied to this data. **2**

(*b*) In planning the application development, it was suggested that using an object-oriented language may lead to a shorter implementation time and would help the maintainability compared to the use of a procedural language.

Explain why this may be true. **2**

(*c*) Describe how a declarative language could be used to represent and manipulate the data. **1**

(60)

[*END OF SECTION I*]

SECTION II

Attempt ONE sub-section of Section II

For the sub-section chosen, attempt *all* questions.

[Turn over

Marks

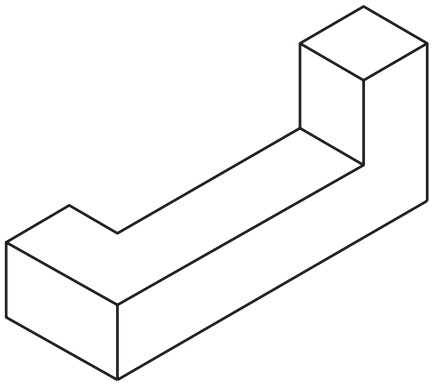
SECTION II

Part A — Artificial Intelligence

Answer ALL questions in this section.

6. A manufacturing company uses an assembly line to make four different types of coat hooks. The assembly line uses a robot with a vision system to pick up the coat hooks from a conveyor belt and sort the coat hooks for packaging.

One of the four types of coat hook is shown below:

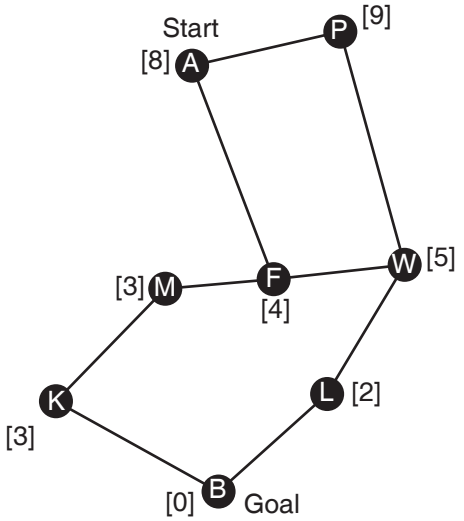


(*a*) The robot is capable of *machine learning*. Name and describe **two** types of machine learning. **4**

(*b*) The system makes use of the *Waltz algorithm*. Apply the Waltz algorithm to this shape. **3**

Part A — Artificial Intelligence (continued)

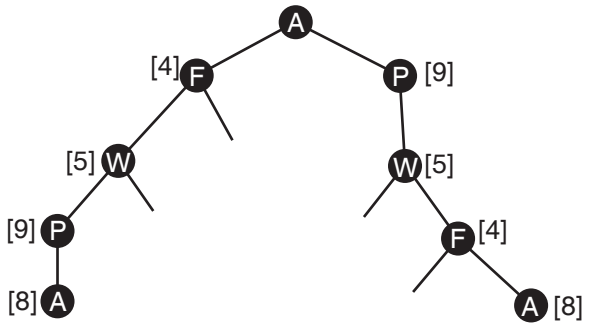
7. *Search techniques* can be used to solve route finding problems. The diagram below shows the connecting roads between different towns. The problem is to find a route from town A to town B.



The values next to each town represent the straight line distance from that town to town B. The diagram is not drawn to scale.

(*a*) A partially completed search tree is shown below. Two of the branches which return to the initial state have been terminated.

Copy the search tree and complete the four missing branches until they reach the goal. **4**



(*b*) State **one** way in which a *state space graph* can differ from a search tree. **1**

(*c*) Explain why the *hill-climbing* search algorithm would not find a solution. **2**

[Turn over

SECTION II

Marks

Part A — Artificial Intelligence (continued)

7. (continued)

(*d*) The *best first* search algorithm could be used to search for a route from A to B. From the start state A, the nodes F and P would be evaluated for consideration. Node F would be selected. This is shown in the table below.

Copy and complete the table below until the goal state B is reached.

Nodes under consideration	Node Selected
F, P	F
P, W, M	M

2

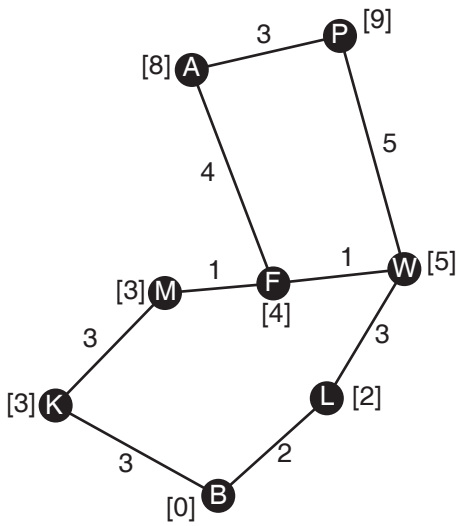
SECTION II

Marks

Part A — Artificial Intelligence (continued)

7. (continued)

(*e*) The diagram below includes the distances between the towns.



An *evaluation function* assigned to a node is now to be :

(Straight line distance from that node to goal state B) + (Distance travelled to the node)

(i) Name another heuristic search algorithm which would make use of this additional information. **1**

(ii) From the start state this algorithm would consider node F with value 8 and node P with value 12. Node F would be selected. Nodes W and M would then be added to the nodes under consideration and node M selected. Copy and complete the table below until the goal state B is reached.

Nodes under consideration including Evaluation Function	Node Selected
F [8], P[12]	F
P[12], M[8], W[10]	M

3

(iii) State the route from town A to town B identified by this algorithm. **1**

[Turn over

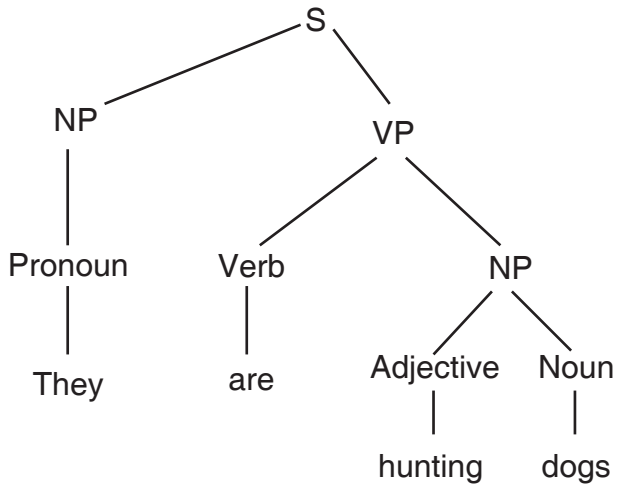
SECTION II

Marks

Part A — Artificial Intelligence (continued)

8. Ambiguity can result if more than one valid parse tree can be created from a sentence. A *parse tree* for a sentence is shown below:

They are hunting dogs.



(*a*) (i) Name the stage of *natural language understanding* at which parsing takes place. **1**

(ii) "Hunting" could result in a different parse tree. Explain why. **1**

(*b*) Parsing of a sentence is performed by using rules. Some of the rules used to parse the sentence above are shown below:

Rule	
S → NP, VP	A sentence consists of a noun phrase and a verb phrase.
NP → Noun	A noun phrase consists of a noun.
NP → Adjective, Noun	A noun phrase consists of an adjective and a noun.
NP → Pronoun	A noun phrase consists of a pronoun.
VP → Verb, NP	A verb phrase consists of a verb and a noun phrase.

(i) State **one** other possible rule for a noun phrase (NP). **1**

(ii) State **one** example of a noun phrase that would match your rule in (*b*)(i). **1**

(*c*) *Semantic analysis* will take place after parsing the sentence. State the purpose of semantic analysis. **1**

(*d*) Having completed syntactic and semantic analysis, name and describe the next stage of natural language understanding. **2**

SECTION II

Marks

Part A — Artificial Intelligence (continued)

8. (continued)

(*e*) The following Prolog list is used to store some nouns:

[dogs, cats, girls, boys]

(i) State the output to the following query:

? [H|T]= [dogs, cats, girls, boys] **2**

(ii) Membership of a list in Prolog can be defined using two rules.

member_of(X,[X|Tail]).

member_of(X,[Head|Tail]):-member_of(X,Tail).

Explain how Prolog would use recursion to evaluate the following query:

? member_of(girls, [dogs, cats, girls, boys]). **4**

[Turn over

SECTION II

Marks

Part A — Artificial Intelligence (continued)

9. An *expert system* contains the following knowledge base with five rules.

Knowledge Base		**Explanation**
1	If C and F then L	If condition C is true and condition F is true then L is true.
2	If X and B and E then Y	
3	If A then X	
4	If Y and D and L then Z	
5	If L and M then N	

(*a*) The expert system uses *forward-chaining*. Describe how forward chaining attempts to reach a conclusion. **2**

(*b*) The facts A, B, C, D, E and F are known to be true and are currently stored in working memory.

Knowledge Base	
1	If C and F then L
2	If X and B and E then Y
3	If A then X
4	If Y and D and L then Z
5	If L and M then N

Working Memory Facts
A B C D E F

This means that there is a *conflict set*.

(i) Explain what is meant by a conflict set. **1**

(ii) Identify the conflict set for the situation shown in the table. **1**

(iii) Name and describe how a conflict set can be dealt with in a forward chaining expert system. **2**

(iv) If the expert system reasons that Z is true then this will be output. Using the facts in working memory, explain how the goal Z could be reached using forward chaining. **4**

(*c*) Rule 2 is amended to include certainty factors. It is changed to:

If X and B and E then Y (CF 0.7)

The certainty factors of the conditions are as follows:

- X has certainty factor 0.9
- B has certainty factor 0.8
- E has certainty factor 0.9

Calculate the certainty factor of the conclusion Y. **2**

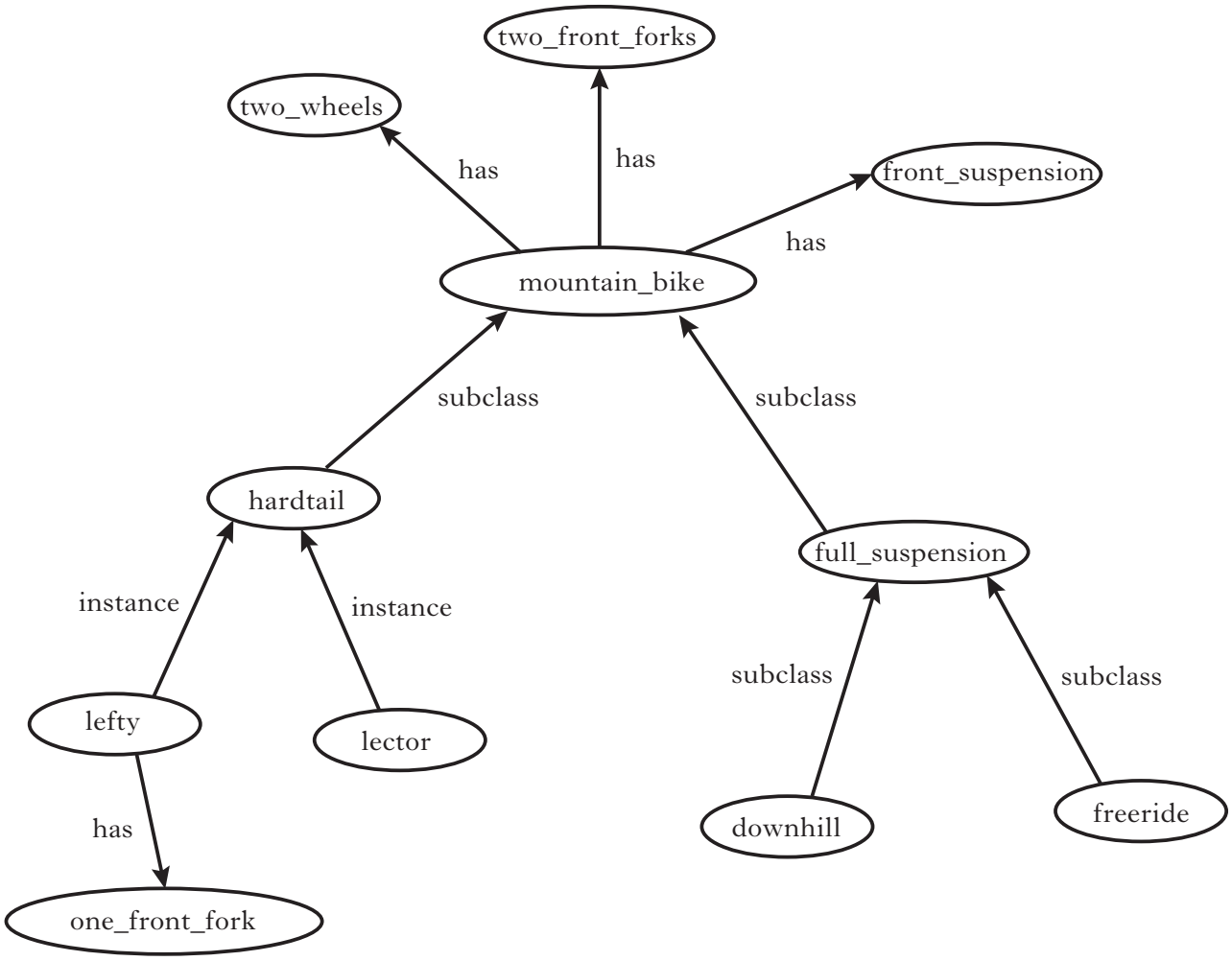
(*d*) Testing has identified that the expert system is not reliable. Describe **one** technique that could be used to debug the expert system. **2**

SECTION II

Part A — Artificial Intelligence (continued)

Marks

10. Some information about bikes is stored in a *semantic net*.



(*a*) Represent this information using a *frame* for nodes:

(i) mountain bike; **1**

(ii) hardtail; **1**

(iii) lefty. **1**

(*b*) Use this example to explain the term *default value*. **2**

(*c*) Describe the difference between an *instance* and a *subclass*. **2**

(*d*) Represent the information in the semantic net using Prolog facts of the form **relation(argument,argument)**. **3**

(*e*) The rule that establishes that downhill and freeride bikes are a subclass of mountain bike is:

subclass(X,Y):- subclass(X,Z), subclass(Z,Y).

Write the **additional rule** that will ensure subclasses of mountain bikes inherit all the properties of a mountain bike. **2**

(60)

[*END OF SECTION II PART A*]

SECTION II

Marks

Part B — Computer Architecture

Answer ALL questions in this section.

11. (*a*) Each type of processor has a unique instruction set. An instruction may have several associated *addressing modes*.

(i) Explain what is meant by an addressing mode. **1**

An instruction in the *assembly language* of a particular processor is DEX. This carries out the operation "reduce the value stored in the X register by one". This is an example of an instruction using implied addressing mode.

(ii) Explain what is meant by the term "implied addressing mode". **1**

The assembly language for this processor includes the following instructions:

LDA #N	Load the numeric value N into the A register.
LDX M	Copy the contents of memory location M into the X register.
ADD M	Add the value stored in memory location M to the A register.
DEX	Reduce the value stored in the X register by one.
BNE L	Branch to the line labelled L if the last operation did not result in value zero.
STA M	Copy the value stored in the A register into memory location M.

(iii) Choose **one** of the *data transfer instructions* and describe the addressing mode used by the instruction. **2**

(*b*) The listing of an assembly language program is shown below:

Line No.	**Label**	**Instruction**
1		LDA #0
2		LDX Location1
3	Continue	ADD Location2
4		DEX
5		BNE Continue
6		STA Location3

Initially, Location1 is storing the numerical value 3 and Location2 is storing the value 2.

SECTION II

Marks

Part B — Computer Architecture (continued)

11. (*b*) (continued)

The table below shows the values stored in the A and X registers after lines 1 and 2 have been executed.

Line	A	X
1	0	
2	0	3

(i) **Copy the table into your answer book.** Then, by performing a dry run, complete the table to show the values that will be stored in the A and X registers as the program is run to line 6. **3**

(ii) Hence state the purpose of this program. **2**

(iii) In a previous version, the programmer had mistakenly labelled Line 4 with "Continue" instead of Line 3. Describe the effect of this mislabelling, given the same initial values stored in Location1 and Location2. **2**

(iv) This processor uses 8 bit registers. Explain why this register size may cause an incorrect result for certain values stored in Location 1 and Location 2. **2**

[Turn over

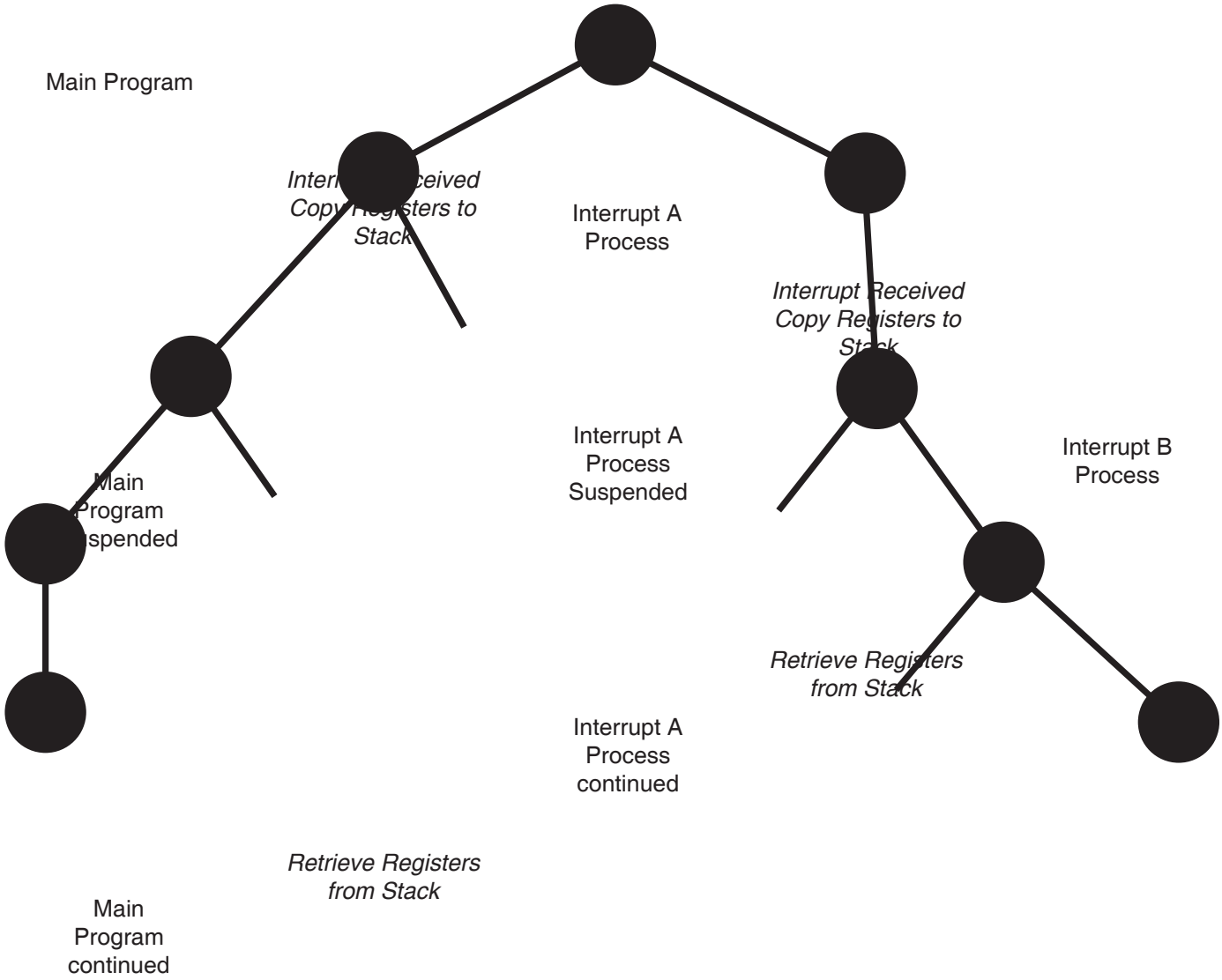
SECTION II

Marks

Part B — Computer Architecture (continued)

12. The "WildCat" processor is executing a program when an interrupt occurs. The interrupt causes the processor to execute a routine to copy the values that are stored in several registers to a *stack* before servicing the interrupt. When the interrupt process has completed, these register values can be retrieved from the stack so that the processor can continue with its original program.

An interrupt may occur at any time, even when another interrupt is being processed. An example situation is shown in the following diagram.



(*a*) It would not be appropriate to use a *queue* to store the register values.

Explain why a stack is the structure used to store the register values. **1**

SECTION II

Marks

Part B — Computer Architecture (continued)

12. (continued)

(*b*) The instruction used to copy the value stored in a register to the stack is PUSH followed by the register name; for example, for the A register, the instruction would be PUSH A.

When an interrupt occurs, the following code is used to copy the A, R1, R2 and PC register values onto the stack.

```
PUSH A
PUSH R1
PUSH R2
PUSH PC
```

When the interrupt process has completed, state which register value will be the first to be retrieved from the stack. **1**

13. The WildCat processor is provided with 16Kb of Level 1 *cache* and 512Kb of Level 2 cache.

(*a*) Explain why two levels of cache are provided rather than a single large Level 1 cache. **2**

(*b*) "Cache miss" is the term used to describe the situation when data requested by the processor is not found in a cache. With reference to Level 1 cache, Level 2 cache and main memory, describe what happens when a cache miss occurs in Level 1 cache. **3**

[Turn over

SECTION II

Marks

Part B — Computer Architecture (continued)

14. (*a*) A computer is running a photo editing program. Each pixel in the display is mapped to a location in memory. A library subroutine of code is available which will increase the brightness of all of the pixels in an area of the display. It does this by using the following algorithm:

> *For each pixel in the display area*
> *Copy the value stored in the mapped memory location to the A register*
> *Add a value to the A register corresponding to the required brightness increase*
> *Copy the A register back to the same memory location*
> *End Loop*

A developer has suggested that rewriting the algorithm to use a *SIMD instruction* will improve the performance of the subroutine. The WildCat processor includes some SIMD instructions in its instruction set.

(i) State what is meant by a SIMD instruction. **1**

(ii) Describe how the use of a SIMD instruction could improve the performance of this subroutine. (You do not have to write a new algorithm.) **2**

(*b*) The data bus of the processor is 32 bits wide and the address bus is 64 bits wide.

Each pixel is mapped to a 32 bit memory location.

There are 16 SIMD registers provided, each of which is 128 bits wide and each can hold multiple data items.

Each SIMD operation can use all of the SIMD registers.

(i) Calculate the theoretical improvement in the performance of the processor when using SIMD instructions. Show your working. **2**

(ii) Explain why the actual improvement in performance is likely to be less than this. **1**

SECTION II

Marks

Part B — Computer Architecture (continued)

15. The WildCat processor is a superscalar processor designed with *RISC architecture* features.

(*a*) One RISC feature is that all instructions are of a fixed length.

Explain why having fixed length instructions leads to an efficient processor. **1**

(*b*) Another RISC feature is that there are a large number of general purpose registers in the processor.

Explain why having a large number of general purpose registers could lead to an efficient processor. **2**

(*c*) State **one** other feature of RISC architecture. **1**

(*d*) The processor uses the technique of *speculative loading of data* in order to improve the efficiency of processing.

Describe the technique of speculative loading of data. **2**

(*e*) The processor has several pipelines. When instructions are being executed in parallel, a pipeline may stall whilst waiting for dependent data to be processed in another pipeline.

Name and describe a technique for parallel processing that may reduce the problem of stalling. **3**

16. A supercomputer has a total of 64200 processors working in parallel.

(*a*) Describe how memory may be structured in a computer with so many processors. **2**

(*b*) Describe how packet switching can be a suitable method of enabling efficient communication between all these processors. **2**

[Turn over

SECTION II

Marks

Part B — Computer Architecture (continued)

17. Andy has a computer that has the Frames 5 *operating system* installed. He has received an e-mail stating that he can now upgrade the operating system to Frames 6.

(*a*) Frames 6 has a *library of objects* (known as the API) to provide various services. Applications can call on these objects as required.

(i) State **two** reasons why Frames 6 provides a library of objects. **2**

(ii) Describe **one** service relating to **file management** that the Frames 6 API may provide to a word processor application. **1**

(iii) Describe **one** service relating to **the user interface** that the Frames 6 API may provide to a word processor application. **1**

(*b*) A new feature of Frames 6 is that it includes support for touch sensitive displays.

Andy opens an application to display a folder of photos.

If he has a touch screen, he can either make use of the new touch screen features, the mouse or the keyboard to move on to the next photo.

By referring to these options, explain the difference between the terms *syntax* and *semantics*. **2**

(*c*) Frames 6 has a pre-emptive scheduling system that uses a multi-level feedback queue whereas Frames 5 used a round robin queue.

Describe what is meant by a pre-emptive scheduling system. **1**

Part B — Computer Architecture (continued)

17. (continued)

(*d*) During normal operation, the operating system will be scheduling a large number of active processes. Many of these will be dealing with user interactions which are of very short duration (such as responding to mouse clicks) but others will be of very long duration (such as sorting a large database). The designers of Frames 6 took this wide variation of processing times into account when deciding to use a multi-level feedback queue for the scheduling system rather than a round robin queue.

By comparing the features of a multi-level feedback queue and a round robin queue, explain why the designers decided that it would be better to use a multi-level feedback queue for Frames 6. **4**

18. The Frames 6 operating system uses a *contiguous method of allocating files* on a hard disk.

(*a*) Describe **two** advantages of contiguous file allocation compared with *non-contiguous file allocation*. **2**

(*b*) With contiguous file allocation, the operating system must be able to determine whether there is a large enough block of contiguous clusters on the hard disk that the file can fit into.

Describe a method that the operating system can use to monitor which clusters on a hard disk are currently being used for data. **2**

(*c*) During normal operation of the computer, files are created on and deleted from the hard disk. This could lead to fragmentation.

In the context of **contiguous file allocation**:

(i) Explain what is meant by fragmentation. **1**

(ii) Describe a consequence of this fragmentation. **1**

(iii) Describe a solution to this problem. **2**

(iv) Before this solution has been implemented, the time taken to read a certain file on the hard disk is 742 milliseconds. After the fragmentation solution has been implemented, describe how the read time of this file would be affected. Justify your answer. **2**

(60)

[*END OF SECTION II—PART B*]

[Turn over for Section II Part C

SECTION II

Marks

Part C — Computer Networking

Answer ALL questions in this part.

19. A multinational company has developed a new wireless networking protocol designed to transfer high quality video to a large number of users. The protocol has a transfer rate of 250 Mbps and an outdoor range of 500 metres. It is not compatible with 802.11 wireless standards.

(*a*) (i) By comparing the technical specifications of the two protocols, explain why businesses might want to use this new protocol rather than 802.11n. **3**

(ii) Explain why customers may be reluctant to purchase equipment which uses the new wireless networking protocol. **2**

(*b*) (i) State the layer of the *OSI model* within which 802.11n operates. **1**

(ii) Show how the layers of the TCP/IP model relate to the layers of the *OSI model*. **3**

(*c*) In developing the new protocol, the company has determined that it is legally feasible to replace the current 802.11 protocols.

Describe **three** other aspects of feasibility that the company had to consider when deciding whether to implement the new protocol in their premises. **3**

20. Different methods can be used to allocate groups of IP addresses to networks, and to parts of networks.

(*a*) Groups of IP addresses can be allocated to networks using *Classless Inter-Domain Routing* (*CIDR*).

(i) Using the CIDR address 189.25.60.15/22 describe how CIDR operates. **2**

(ii) Calculate the number of hosts that can exist on a network with CIDR address 189.25.60.15/22. **2**

(iii) Use the CIDR address 189.25.60.15/22 to explain why CIDR is more efficient at allocating IP addresses than the class based IP address system. **2**

(*b*) The use of *subnetting* can allow network allocations to be further subdivided.

(i) Calculate the value of the *subnet mask* which would allow the 189.25.60.15/22 network to be divided into eight equally sized subnets. **2**

(ii) State **two** benefits of dividing a network into distinct subnets. **2**

SECTION II

Marks

Part C — Computer Networking (continued)

21. Hootenanny High School has buildings in the city centre and has acquired a sports centre on the edge of the city. The Head Teacher wants staff and pupils working at the sports centre to be able to access the school network.

The network currently uses UTP cable to connect all the devices together in each building. The Network Manager plans to use fibre optic cable to connect the school to the sports centre.

(*a*) (i) State the range and bandwidth of UTP and fibre optic cable. **2**

(ii) Explain why UTP cable is used within the school network, while fibre optic cable will be used to connect the two sites. **3**

(*b*) One of the advantages of the sports centre being connected to the school network is that the PE Department computers can be included in the school's daily backup schedule.

(i) Distinguish between full, differential, and incremental backups. **3**

(ii) The school uses a weekly backup schedule. Describe a weekly backup schedule which uses all three types of backup. **3**

(*c*) The school is evaluating a video conferencing system so that staff can attend school meetings without travelling between the sites.

(i) Describe what is meant by the *sample rate* of a video camera. **1**

(ii) When comparing video cameras, state **two** reasons why the camera with a higher sample rate might have a negative impact on performance. **2**

(iii) A video signal has to be sent securely between the two sites. Describe how *public key encryption* could be used to allow this. **3**

(*d*) The school's Network Manager is responsible for the security of systems and data on the intranet.

(i) A *firewall* is used to protect the intranet.

State **two** examples of firewall rules that might be used to protect the network from unauthorised external access. **2**

(ii) Access to the Internet is processed through a *proxy*.

Describe **two** features of a proxy and explain how they would protect the school's network. **4**

(iii) Name one *intermediate* other than a proxy, and explain how it could be used to protect the security of the school's network. **2**

(*e*) The school must consider the legal implications of its use of computer networks. Name a specific law relating to computer use the school must consider, and explain how it could impact their daily operations. **2**

SECTION II

Marks

Part C — Computer Networking (continued)

22. Charlie, lead developer at website development studio Web4U, requires a training guide to instruct new employees on how to build a website.

(*a*) The training guide is to have a section on the use of the *style* tag.

(i) Write the HTML which would use styles to render all paragraph text on a web page in blue. **3**

(ii) Many styles can be stored in a stylesheet rather than embedded in an HTML page.

Describe **two** advantages of using stylesheets for this purpose. **2**

(*b*) Interactive elements can be added to websites using *Java* or *ActiveX*.

(i) Describe **two** benefits of using Java rather than ActiveX. **2**

(ii) Describe a situation where it may be more appropriate to use ActiveX. **1**

(*c*) The training guide will include links to video tutorials to teach HTML.

(i) Name a *browser plug-in* that could be used to view the video tutorials. **1**

(ii) Explain why a web browser might need a browser plug-in to view the video tutorials. **1**

(iii) Explain how some web browsers are able to display videos without the need for a separate plug-in. **1**

(60)

[*END OF SECTION II—PART C*]

[*END OF QUESTION PAPER*]

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