OCR
RECOGNISING ACHIEVEMENT

Advanced GCE

COMPUTING

F453 QP

Unit F453: Advanced Computing Theory

Specimen Paper

Time: 2 hours

Candidates answer on the question paper.

Candidate Name										
Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Answer **all** the questions.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part of question.
- The total number of marks for this paper is **120**.

ADVICE TO CANDIDATES

- Read each question carefully and make sure you know what you have to do before starting your answer.

FOR EXAMINER'S USE		
	Max	Mark
1	14	
2	15	
3	19	
4	10	
5	6	
6	11	
7	13	
8	8	
9	11	
10	13	
TOTAL	120	

This document consists of **16** printed pages.

Answer **all** questions

1 (a) (i) Give **one** example of an interrupt that allows the job to be resumed after the system has serviced the interrupt.

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.....**[1]**

(ii) Describe how the system ensures that it is possible to resume the interrupted job.

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.....**[2]**

(b) (i) Explain why operating systems use scheduling.

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(ii) Round-robin scheduling is one method that may be used by a multi-user operating system. Describe round-robin scheduling.

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(c) An operating system may use segmentation or paging.

(i) Describe **two** ways in which segmentation and paging are similar.

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.....**[2]**

(ii) Describe **two** ways in which segmentation and paging are different.

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2 (a) Describe the steps taken by an assembler.

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.....**[4]**

(b) Some compilers produce intermediate code for a virtual machine.

(i) Explain **two** advantages of using intermediate code.

1 .....

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2 .....

.....**[2]**

(ii) Explain the meaning of the term virtual machine and how intermediate code is run on it.

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.....**[2]**

(c) (i) Describe what is meant by a library routine and its use when producing programs.

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(ii) Describe how library routines are used when producing software.

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3 (a) Discuss the use of different computer architectures for different problem solutions.

The quality of your written communication will be assessed in your answer to this question.

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(b) (i) Describe parallel processing.

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.....**[5]**

(ii) Describe **one** advantage and **one** disadvantage of a parallel processor compared with a single processor system.

Advantage .....

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Disadvantage .....

.....**[2]**

(c) Explain, with the aid of an example, the following statement:

"A co-processor is a simple form of parallel processor."

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.....**[2]**

(d) Explain the use of an array processor.

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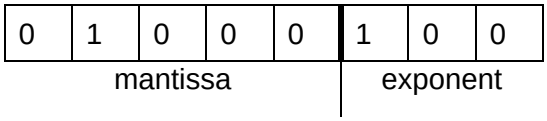
.....**[2]**

4 *In each part of this question, all working must be shown.*

A real binary number may be represented in normalised floating point binary notation using 5 bits for the mantissa and 3 bits for the exponent, both in two's complement binary.

The diagram shows the binary number 01000100 in this format.



(a) Convert 01000100 to denary.

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.....**[3]**

(b) Write the denary number +5 in this binary format.

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.....**[3]**

(c) **(i)** Write, in this format, the largest (positive) binary number that can be represented.

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.....**[1]**

(ii) Give the denary equivalent of this largest (positive) binary number.

.....

.....**[1]**

(d) If, instead, 4 bits are used for the mantissa and 4 bits for the exponent, state the effect on the range and accuracy of the numbers that can be represented.

Range.....

.....

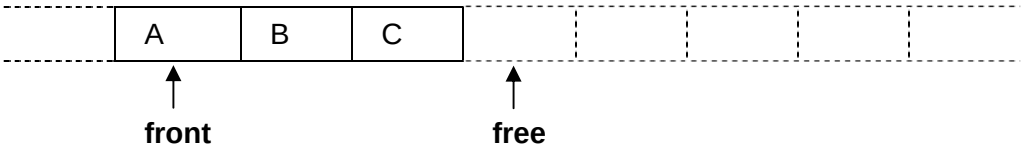
Accuracy.....

.....**[2]**

5 **(a)** The diagram shows a queue data structure storing data items A, B and C. Two pointers are used:

front points to the first item in the queue

free points to the free space immediately after the queue



Complete the diagrams below to show the result of each change. For each example, you should start from the original queue.

(i) Two items are removed from the queue. **[1]**

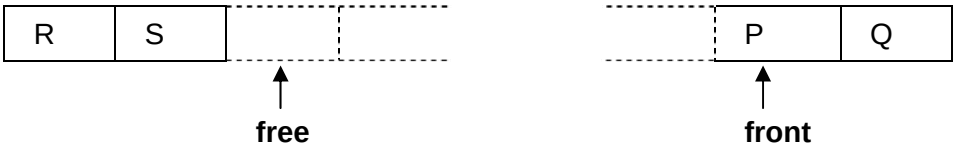
(ii) One item D is added to the **original** queue. **[1]**

(b) The queue in part (a) is a dynamic data structure. State the meaning of the term dynamic in this context.

.....

.....**[1]**

(c) A queue data structure could be represented by a circular queue. For example:



(i) Explain why this representation of a queue may be more efficient.

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.....**[2]**

(ii) Describe the situation in which the free and front pointers have the same value.

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.....**[1]**

6 A declarative language is used to give information about a number of shapes that have straight edges.

```
flat(A).          {shape A is flat}
flat(B).
solid(C).         {shape C is solid}
equal(A).         {edges of shape A are of equal length}
edges(A,3).       {shape A has 3 edges}
edges(B,4).
regular_polygon(X) := flat(X), equal(X).
triangle(X) := flat(X), edges(X,3).
```

(a) State the meaning of the following terms.

(i) backtracking

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.....**[1]**

(ii) instantiation

.....

.....**[1]**

(b) From the information given, show how any solutions to the query are found.

?triangle(T)

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.....**[4]**

(c) Using the same notation, define the shape **pent** which is a flat shape with 5 edges of equal length.

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.....**[3]**

(d) Describe the difference between declarative languages and procedural languages.

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7 (a) A system uses the following definitions in Backus-Naur form (BNF).

<DIGIT> ::= 0 | 1 | 2 | 3 | 4

<ALPHA> ::= P | Q | R | S

<CODE> ::= <ALPHA> <DIGIT> | <ALPHA> <CODE>

Each of the following is **not** a valid code. From the definitions given, show where the rules have been broken.

(i) T3

.....

.....**[1]**

(ii) PQ23R

.....

.....**[1]**

(b) Use the BNF definitions from (a) to write a definition for NUMBER, where NUMBER has one or more DIGITs.

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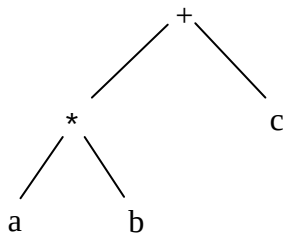
.....**[2]**

(c) Draw a syntax diagram to represent the definition of IDENTIFIER, where IDENTIFIER has one ALPHA, then one DIGIT, followed by at least one CODE.

*(You do **not** have to draw diagrams for LETTER, DIGIT or COD*E.)

[3]

(d) **(i)** The binary tree shows operands a, b and c with operators + and *.



Obtain the reverse Polish form of the expression by using post-order traversal of the tree.

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.....**[2]**

(ii) An expression in reverse Polish notation is fgh*+

Show how a stack may be used to evaluate this expression when f=3, g=4 and h=5.

[4]

8 **(a)** State the type of addressing described in each of the following.

(i) Add the number 13 to the contents of the accumulator.

.....

.....**[1]**

(ii) Add the number stored in address 25 to the contents of the accumulator.

.....

.....**[1]**

(b) In the context of assembly languages, state the meaning of the following terms:

(i) opcode (operation code)

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.....**[1]**

(ii) operand

.....

.....**[1]**

(c) Describe the use and purpose of the index register.

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.....**[3]**

(d) Describe the relationship between assembly language and machine code.

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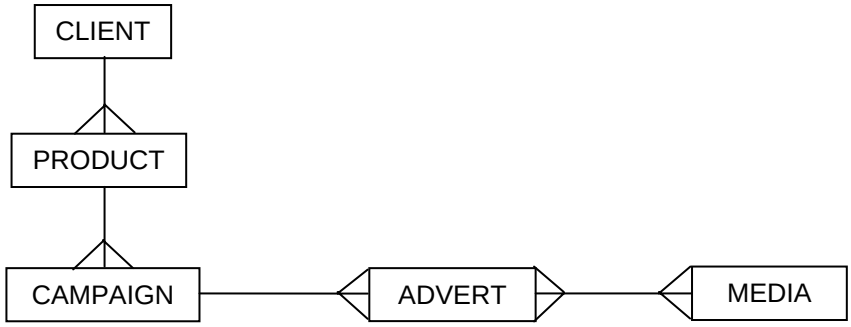
.....**[1]**

9 An advertising company produces advertisements for clients. Data is stored in a relational database.

When a client wants to launch a new product or improve sales, a campaign is prepared. The campaign may include a number of adverts for television, radio and magazines. Different adverts for a product may use the same media items (e.g. video clips, music, photos).

This is shown on the entity-relationship (E-R) diagram.



(a) **(i)** From the diagram, describe the relationship between CAMPAIGN and ADVERT.

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.....**[1]**

(ii) Draw this E-R diagram in third normal form (3NF).

[3]

(b) The database designer considers including the following attributes in the tables used for PRODUCT and CAMPAIGN.

PRODUCT (ProdId, ProdName …)

CAMPAIGN (CampaignId, ClientId, ProdId, Fee, StartDate …)

(i) Define the term primary key.

.....

.....**[1]**

(ii) Give **one** example of a primary key in this database.

.....**[1]**

(iii) Explain why ClientId (from the CLIENT table) should **not** be included in the CAMPAIGN table.

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.....**[2]**

(c) The following shows some of the Structured Query Language (SQL) used to obtain data from the database.

```
SELECT CampaignId, ProdId, Fee, StartDate
FROM CAMPAIGN
WHERE Fee > 20000
ORDER BY Fee DESC;
```

Describe the purpose of this code.

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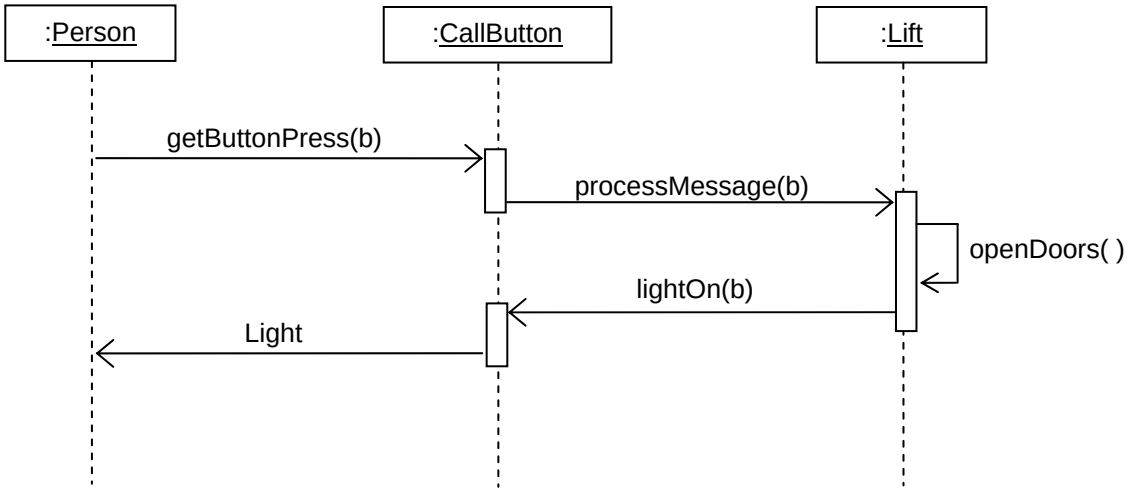
.....**[3]**

10 (a) A shop has a lift which may be used by customers and staff.

The Unified Modelling Language (UML) sequence diagram shows what happens when a person presses the button to call the lift when the lift is already at the correct floor.



(i) Explain the meaning of the vertical dotted lines in the diagram.

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.....**[2]**

From the diagram, give one example of each of the following.

(ii) An object.

.....**[1]**

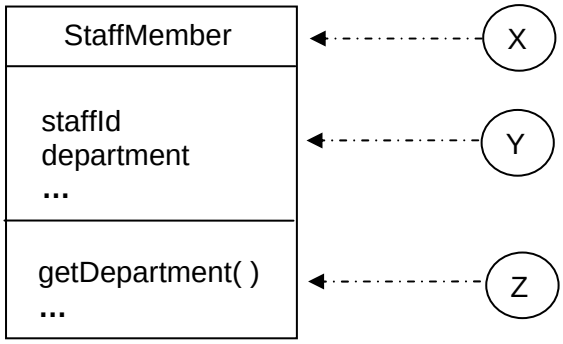
(iii) A message.

.....**[1]**

(iv) A signal.

.....**[1]**

(b) This is one of the class diagrams for the shop, with sections labelled X, Y and Z.



(i) State the meaning of each section of the diagram.

X .....

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Y .....

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Z .....

.....**[3]**

(ii) Explain the meaning of the ellipsis (…) in section Z.

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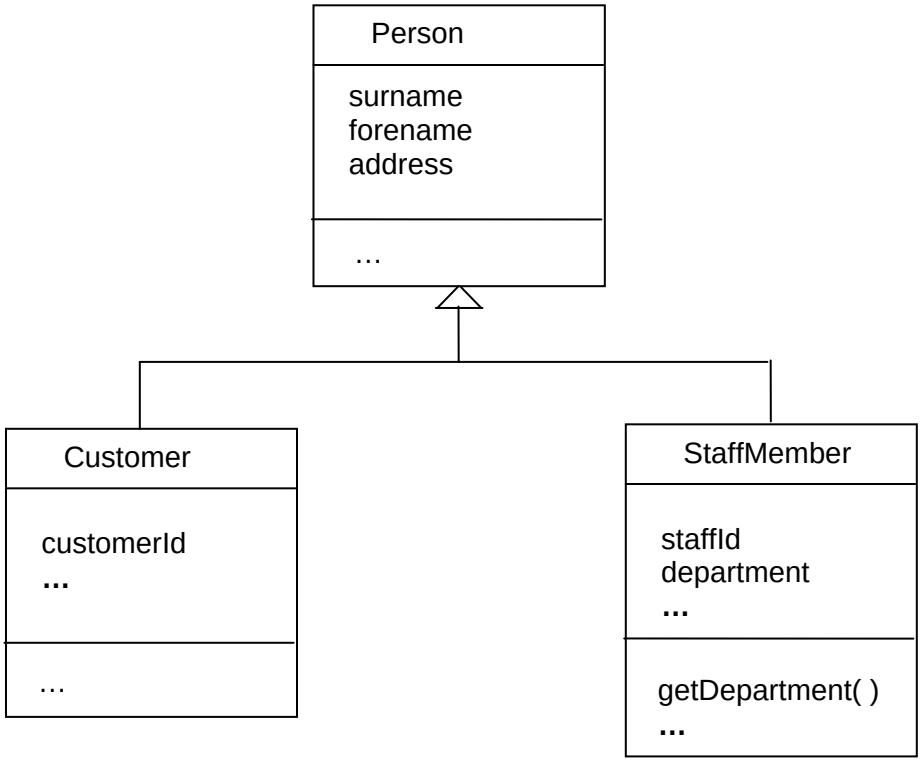
.....**[1]**

(c) This shows another class diagram.



Using this diagram, explain the term inheritance.

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.....**[4]**

Paper Total [120]

Copyright Acknowledgements:

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

COMPUTING F453 MS

Unit F453: Advanced Computing Theory

Specimen Mark Scheme

The maximum mark for this paper is **120**.

Question Number	Answer	Marks
1(a)(i)	**Give one example of an interrupt that allows the job to be resumed after the system has serviced the interrupt.** • Peripheral e.g. printer (buffer empty) • user interrupt e.g. new user log on request. [1 per bullet, max 1]	**[1]**
1(a)(ii)	**Describe how the system ensures that it is possible to resume the interrupted job.** • Values taken from registers • values stored on stack • so they can be replaced in registers (when ISR has finished). [1 per bullet, max 2]	**[2]**
1(b)(i)	**Explain why operating systems use scheduling.** • Ensure all tasks are processed … • … by changing priorities where necessary • process as many jobs as possible … • … in the least possible time • maximise number of interactive users … • … receiving fast response times. [1 per bullet, max 4]	**[4]**
1(b)(ii)	**Round robin scheduling is one method that may be used by a multi-user operating system. Describe round robin scheduling.** • Each user allocated a time slice • when time slice is up, system moves to next user • if next user needs processor, user given time slice • repeat until all users serviced • users may have different priorities • time slices are very small/fractions of seconds • no apparent delay for any user. [1 per bullet, max 3]	**[3]**
1(c) 1(c)(i)	**An operating system may use segmentation or paging.** **Describe <u>two</u> ways in which segmentation and paging are similar.** • Allow programs to run despite insufficient memory • segments and pages are stored on disk • segments and pages are assigned to memory when needed. [1 per bullet, max 2]	**[2]**

Question Number	Answer	Marks
1(c)(ii)	**Describe <u>two</u> ways in which segmentation and paging are different.** • Segments are different sizes but pages are fixed size • segments are complete sections of programs, but pages are made to fit sections of memory • segments are logical divisions, pages are physical divisions. [1 per bullet, max 2]	**[2]**
2(a)	**Describe the steps taken by an assembler.** • Translates a program from assembly language into machine code • one assembly language instruction is changed into one machine code instruction • reserves storage for instructions and data • replaces mnemonic opcodes by machine codes • replaces symbolic addresses by numeric addresses • creates symbol table to match labels to addresses. [1 per bullet, max 4]	**[4]**
2(b) 2(b)(i)	**Some compilers produce intermediate code for a virtual machine.** **Explain <u>two</u> advantages of using intermediate code.** • Intermediate code is platform-independent/may be used on a variety of machines • intermediate code program has been compiled so is error-free. [1 per bullet]	**[2]**
2(b)(ii)	**Explain the meaning of the term virtual machine and how intermediate code is run on it.** • A virtual machine is a theoretical (or generalised) computer on which the program can run • intermediate code is run using an interpreter (for the specific computer). [1 per bullet]	**[2]**

Question Number	Answer	Marks
2(c)(i)	**Describe what is meant by a library routine and their use when producing programs.** • Piece of software • routines often perform common tasks • routines are compiled • routines are error-free • available to programmer to use with a new program. [1 per bullet, max 4]	**[4]**
2(c)(ii)	**Describe how library routines are used when producing software.** • May allow programmer to use code which was written in a different (source) language • linker is used to link the routine to the program • standard routines for sorting/searching available • allow programmer to use others' expertise • fit into modularisation of algorithm • may be used multiple times • the loader will handle addresses when loaded. [1 per bullet, max 3]	**[3]**

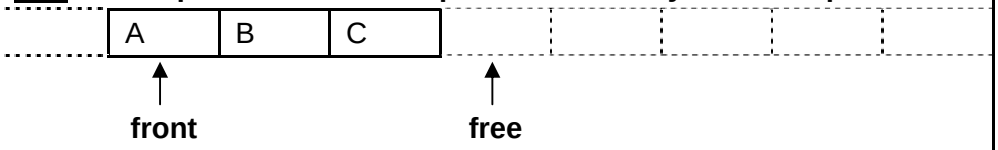
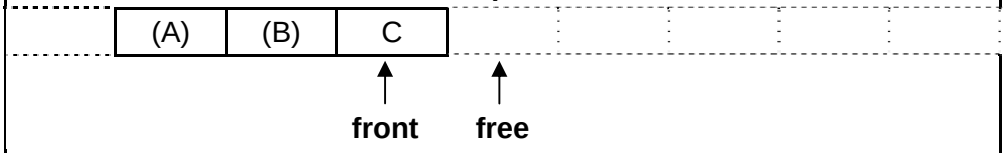
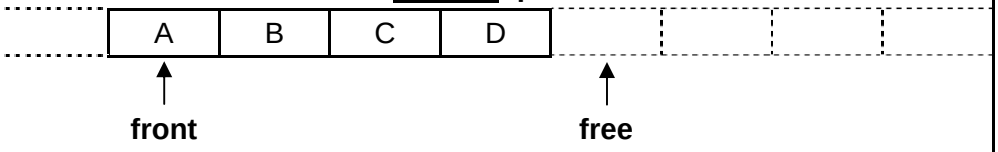
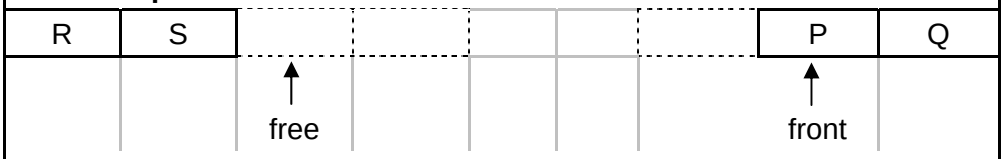
Question Number	Answer	Marks
3(a)	**Discuss the use of different computer architectures for different problem solutions.** **High level response [6-8 marks]** Candidates will show a clear understanding of the problem and answer the question. Candidates will accurately and clearly, as a minimum give both positive and negative implications and a discussion will take place. The information will be presented in a structured and coherent form appropriate to a discussion. There will be few if any errors in spelling, grammar and punctuation. Technical terms will be used appropriately and correctly. **Medium level response [3-5marks]** Candidates will show an understanding of the problem and may answer the question from one viewpoint only. Candidates may only give either positive or negative implications The information will be presented in a structured format appropriate to a discussion. There may be occasional errors in spelling, grammar and punctuation. Technical terms will be mainly correct. **Low level response [0-2 marks]** Candidates may demonstrate a limited understanding of the problem. Information may be a list of points, with no implications. Information will be poorly expressed and the presentation of the information may not be appropriate for a discussion. There will be a limited, if any, use of technical terms. Errors of grammar, punctuation and spelling may be intrusive. **Points to be made:** • Von Neumann architecture • involves the use of data and instruction being held together in memory • sequential processing • involves the use of a sequence of instructions carried out in a specific order to solve a problem • following a specific algorithm • where the order will change the outcome • suits any example where the outcome is dependent on steps being taken in a defined order eg the solution to a formula • necessarily time hungry because it uses a single processor • parallel processing • uses multiple processors • to carry out instructions at the same time • requires complex processing to adapt the sequential algorithm • speeds up arithmetic processes • mention of co-processing • mention of array processing • used in time dependent operations which require large amounts of processor time • eg weather forecasting • explanation of interdependency of conditions in physical blocks	**[8]**

3(b)(i)	**Describe parallel processing.** Points to be made: • More than one processor… • …controlled by a complex operating system • working together… • to perform a single job… • which is split into tasks… • each task may be performed by any processor.	**[5]**
3(b)(ii)	**Describe <u>one</u> advantage and <u>one</u> disadvantage of a parallel processor compared with a single processor system.** Advantage • increased speed/multiple instructions processed at once • complex tasks performed efficiently Disadvantage • not suitable for some programs • programs written specially/may need to be rewritten	**[2]**
3(c)	**Explain, with the aid of an example, the following statement:** **"A co-processor is a simple form of parallel processor."** • A component added to the central processor • improves speed by performing certain tasks • e.g. maths co-processor/floating-point accelerator. [1 per bullet, max 2]	**[2]**

Question Number	Answer	Marks
3(d)	**Explain the use of an array processor.** • A processor that allows any instruction to operate simultaneously on multiple data locations • the same calculation on different data is very fast. [1 per bullet, max 2]	**[2]**
4	**In each part of this question, all working must be shown.** **A real binary number may be represented in normalised floating point binary notation using 5 bits for the mantissa and 3 bits for the exponent, both in two's complement binary.** **The diagram shows the binary number 01000100 in this format.**	

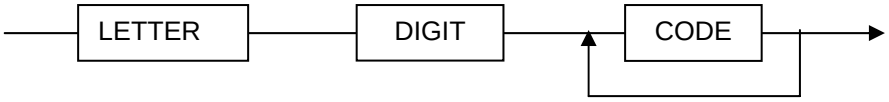
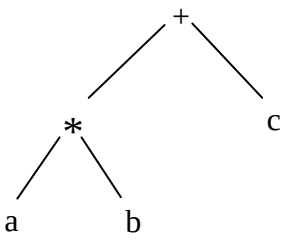
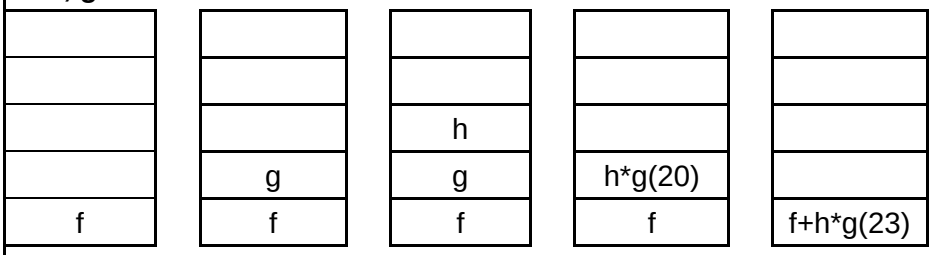
0	1	0	0	0	1	0	0
mantissa					exponent		

4(a)	**Convert 01000100 to denary.** • Exponent 100 represents -4 • mantissa 0.1, move point 4 places left so becomes 0.00001 • value is 1/32 (= 0.03125). *or* • Exponent 100 represents -4 • mantissa 0.1 represents ½ • value is ½ multiplied by 2^{-4} = 1/32 (= 0.03125).	**[3]**
4(b)	**Write the denary number +5 in this binary format.** • (pure binary) 101 • 0.101, point moved 3 places • 3 written as 011 • 01010 011. [max 3 marks]	**[3]**
4(c)(i)	**Write, in this format, the largest (positive) binary number that can be represented.** 01111 011	**[1]**
4(c)(ii)	**Give the denary equivalent of this largest (positive) binary number.** (111.1 equivalent to) 7.5	**[1]**
4(d)	**If, instead, 4 bits are used for the mantissa and 4 bits for the exponent, state the effect on the range and accuracy of the numbers that can be represented.** • Larger range • values less accurate.	**[2]**

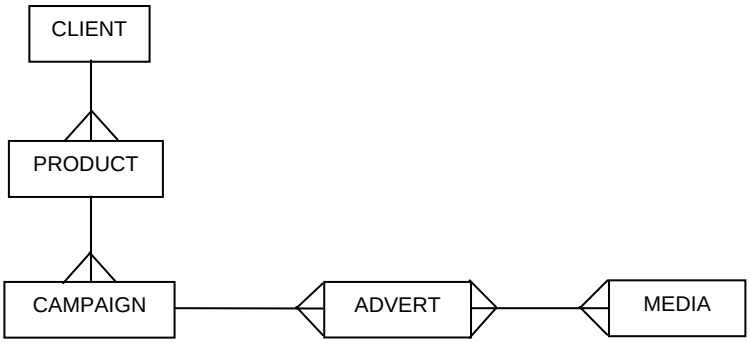
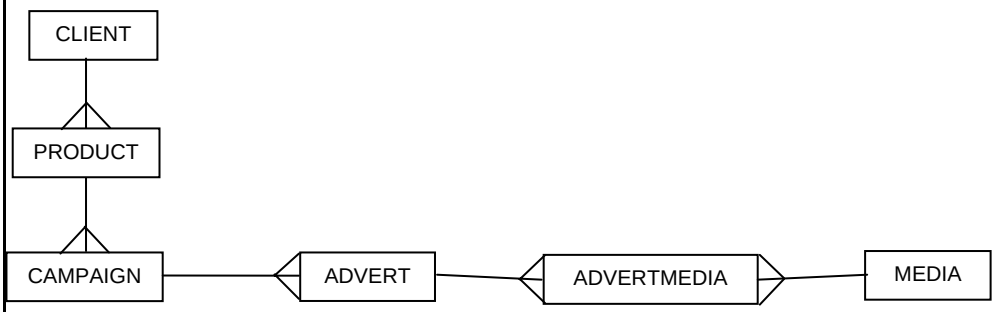
Question Number	Answer	Marks
5(a)	**The diagram shows a queue data structure storing data items A, B and C. Two pointers are used:** **front** points to the first item in the queue. **free** points to the free space immediately after the queue.  **Complete the diagrams to show the result of each change. For each example, you should start from the original queue.**	
5(a)(i)	**Two items are removed from the queue.**  	**[1]**
5(a)(ii)	**One item D is added to the original queue.**  	**[1]**
5(b)	**The queue in part (a) is a dynamic data structure. State the meaning of the term dynamic in this context.** • Size changes as data is added and removed/size is not fixed.	**[1]**
5(c)	**A queue data structure could be represented by a circular queue. For example:**  	
5(c)(i)	**Explain why this representation of a queue may be more efficient.** • Easier to program (because fixed size); • all available storage may be re-used.	**[2]**
5(c)(ii)	**Describe the situation in which the free and front pointers have the same value.** • Queue is empty. [1 mark for bullet]	**[1]**

Question Number	Answer	Marks
6	**A declarative language is used to give information about a number of shapes that have straight edges.** **flat (A). {shape A is flat}** **flat (B).** **solid (C). {shape C is solid}** **equal (A). {edges of shape A are of equal length}** **edges (A,3). {shape A has 3 edges}** **edges (B,4).** **regular_polygon(X) := flat(X), equal(X).** **triangle(X) := flat(X), edges(X,3).**	
6(a)	**State the meaning of the following terms.**	
6(a)(i)	**backtracking** • Going back to a previously found successful match.	**[1]**
6(a)(ii)	**instantiation** • Giving a variable (in a statement) a value.	**[1]**
6(b)	**From the information given, show how any solutions to the query are found.** **?triangle(T)** • T = A, flat(A) • edges(A,3) succeeds ……A • T = B, flat(B) • edges(B,3) fails • no further definitions for flat [1 per bullet, max 4]	**[4]**
6(c)	**Using the same notation, define the shape <u>pent</u> which is a flat shape with 5 edges of equal length** • pent (X) := • flat(X), equal(X), edges(X,5) [*all terms included, in any order*] • correct notation throughout	**[3]**

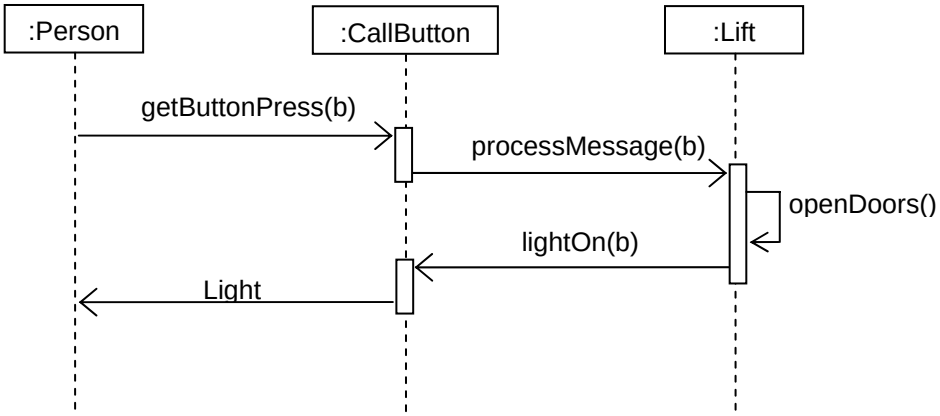
Question Number	Answer	Marks
6(d)	**Describe the difference between declarative languages and procedural languages.** *Declarative* • States what is required. *Procedural* • Describes how to solve a problem. [1 per bullet, max 2]	**[2]**
7(a)	**A system uses the following definitions in Backus-Naur form (BNF)** **<DIGIT> ::= 0 | 1 | 2 | 3 | 4** **<ALPHA> ::= P | Q | R | S** **<CODE> ::= <ALPHA> <DIGIT> | <ALPHA> <CODE>** **Each of the following is <u>not</u> a valid code. From the definitions given, show where the rules have been broken.**	
7(a)(i)	**T3** • T is not <ALPHA>.	**[1]**
7(a)(ii)	**PQ23R** • Only allow one DIGIT.	**[1]**
7(b)	**Use the BNF definitions from (a) to write a definition for NUMBER, where NUMBER has one or more DIGITs.** e.g. <NUMBER> ::= <DIGIT> | <DIGIT> <NUMBER> *marks for* • <NUMBER> ::= <DIGIT> • | <DIGIT> <NUMBER> or | <NUMBER> <DIGIT>	**[2]**

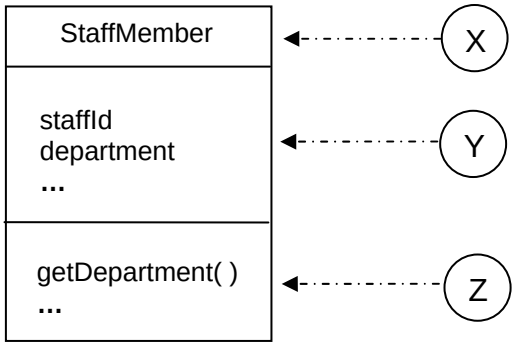
Question Number	Answer	Marks
7(c)	**Draw a syntax diagram to represent the definition of IDENTIFIER, where IDENTIFIER has one ALPHA, then one DIGIT, followed by at least one CODE.** **(You do <u>not</u> have to draw diagrams for ALPHA, DIGIT or CODE).** IDENTIFIER:  *marks for* • Definition label; • 3 terms in order; • correct loop around CODE.	**[3]**
7(d)(i)	**The binary tree shows operands a, b and c with operators + and ***  **Obtain the reverse Polish form of the expression by using post-order traversal of the tree.** ab*c+ [Max 2 marks; 1 mark only for ab*]	**[2]**
7(d)(ii)	**An expression in reverse Polish notation is fgh*+** **Show how a stack may be used to evaluate this expression when f=3, g=4 and h=5.**  	**[4]**

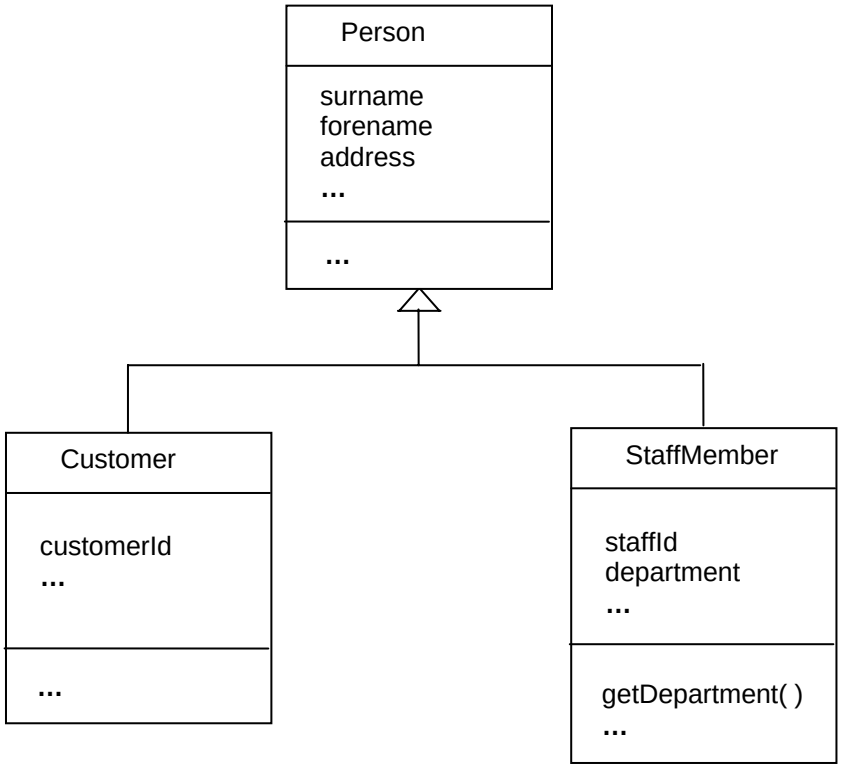
Question Number	Answer	Marks
8(a)	**State the type of addressing described in each of the following.**	
8(a)(i)	**Add the number 13 to the contents of the accumulator.** Immediate.	**[1]**
8(a)(ii)	**Add the number stored in address 25 to the contents of the accumulator.** Direct.	**[1]**
8(b)	**In the context of assembly languages, state the meaning of the term**	
8(b)(i)	**opcode (operation code)** • The (mnemonic) part of the instruction that indicates what it is to do.	**[1]**
8(b)(ii)	**operand** • The data part of the instruction.	**[1]**
8(c)	**Describe the use and purpose of the index register.** • Stores a number used to modify the address in the address field (or data) of an instruction • used in indexed addressing • allows access to a range of memory locations • e.g. used to access an array. [1 per bullet, max 3]	**[3]**
8(d)	**Describe the relationship between assembly language and machine code.** • (Usually) one assembly language instruction is translated into one machine code instruction.	**[1]**

Question Number	Answer	Marks
9	**An advertising company produces advertisements for clients. Data is stored in a relational database.** **When a client wants to launch a new product or improve sales, a campaign is prepared. The campaign may include a number of adverts for television, radio and magazines. Different adverts for a product may use the same media items (e.g. video clips, music, photos).** **This is shown on the entity-relationship (E-R) diagram.**  	
9(a)(i)	**From the diagram, describe the relationship between CAMPAIGN and ADVERT.** • One-many; • one Campaign has one or more Adverts, but each Advert is for only one Campaign.	**[1]**
9(a)(ii)	**Draw this E-R diagram in third normal form (3NF).**  *Marks for* • Only one named link entity, correctly inserted between Advert and Media; • correct relationships around ADVERTMEDIA; • all other relationships correct.	**[3]**

Question Number	Answer	Marks
9(b)	**The database designer considers including the following attributes in the tables used for PRODUCT and CAMPAIGN.** **PRODUCT (<u>ProdId</u>, ProdName …)** **CAMPAIGN (<u>CampaignId</u>, ClientId, ProdId, Fee, StartDate …)**	
9(b)(i)	**Define the term primary key.** • Unique identifier in a table.	**[1]**
9(b)(ii)	**Give <u>one</u> example of a primary key in this database.** • ProdId in Product/CampaignId in Campaign.	**[1]**
9(b)(iii)	**Explain why ClientId (from the CLIENT table) should <u>not</u> be included in the CAMPAIGN table.** • Transitive dependency/knowing ProdID, ClientId can be determined • Campaign is related to Client via Product • if ClientId were included in Campaign, the database would not be in 3NF. [1 per bullet, max 2]	**[2]**
9(c)	**The following shows some of the Structured Query Language (SQL) used to obtain data from the database.** **SELECT CampaignId, ProdId, Fee, StartDate** **FROM CAMPAIGN** **WHERE Fee > 20000** **ORDER BY Fee DESC;** **Describe the purpose of this code.** • Lists attributes CampaignId, ProdId, Fee and StartDate • for all Campaigns that had fees of more than £20000 • in order of Fee from highest to lowest.	**[3]**

Question Number	Answer	Marks
10(a)	**A shop has a lift which may be used by customers and staff.** **The Unified Modelling Language (UML) sequence diagram shows what happens when a person presses the button to call the lift when the lift is already at the correct floor.**  	
10(a)(i)	**Explain the meaning of the vertical dotted lines in the diagram.** • Lifeline of object • earliest time at top down to latest time at bottom.	**[2]**
10(a)(ii)	**From the diagram, give <u>one</u> example of each of the following.** **An object.** • An instance of Person/an instance of CallButton/an instance of Lift.	**[1]**
10(a)(iii)	**A message.** • getButtonPress( ) / processMessage( ) / openDoors( ) / lightOn( )	**[1]**
10(a)(iv)	**A signal.** • Light.	**[1]**

Question Number	Answer	Marks
10(b)	**This is one of the class diagrams for the shop, with sections labelled X, Y and Z.**  	
10(b)(i)	**State the meaning of each section of the diagram.** • X: class name • Y: attributes for the class • Z: operations for the class.	**[3]**
10(b)(ii)	**Explain the meaning of the ellipsis (…) in section Z.** • There are more operations available (the others have been elided) • this simplifies the diagram • only relevant operations are shown. [1 per bullet, max 1]	**[1]**

Question Number	Answer	Marks
10(c)	**This shows another class diagram.**  **Using this diagram, explain the term inheritance.** Points to be made: • A class has all the attributes and operations • …of its superclass… • and may also have attributes & operations of its own; • e.g. an object in StaffMember has surname from Person • …in addition to staffId. *(Other examples from diagram accepted.)*	**[4]**
	Paper Total	**[120]**

Assessment Objectives Grid (includes QWC)

Question	AO1	AO2	Total
1	14		**14**
2	15		**15**
3	15	4	**19**
4	5	5	**10**
5	1	5	**6**
6	5	6	**11**
7	5	8	**13**
8	8		**8**
9	5	6	**11**
10	7	6	**13**
Totals	**80**	**40**	**120**

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