ASSESSMENT and QUALIFICATIONS ALLIANCE

# Mark scheme January 2003

# GCE

## Computing

## Unit CPT4



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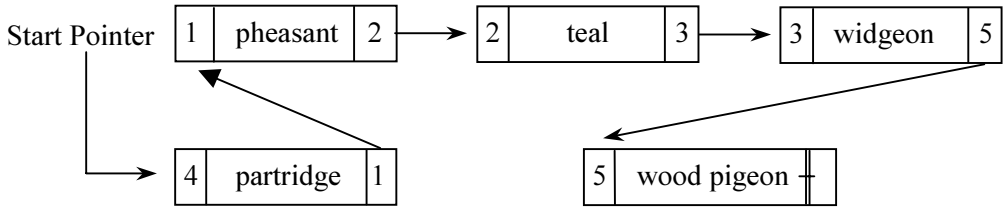
# Unit 4: Processing and Programming Techniques

The following notation is used in the mark scheme:
- ; means a single mark;
- / means alternative response;
- **A** means acceptable creditworthy answer;
- **R** means reject answer as not creditworthy;
- **I** means ignore;
- **BoD** means benefit of doubt

1 a i Data must be in given order

| | | | |
|---|---|---|---|
| | 1 | pheasant | 2 |
| | 2 | teal | 3 |
| | 3 | widgeon | 5 |
| START | 4 | partridge | 1 |
| | 5 | woodpigeon | 0 |

//




*End Pointer can be blank*
*1 for correct START and END pointers;*
*1 for correctly numbered nodes and correct pointers (need all birds);*

ii

| | | | |
|---|---|---|---|
| | 1 | pheasant | 7 |
| | 2 | teal | 3 |
| | 3 | widgeon | 5 |
| | 4 | partridge | 1 |
| | 5 | woodpigeon | 0 |
| START | 6 | grouse | 4 |
| | 7 | snipe | 2 |

// correctly amended diagram

*1 for grouse and snipe physically at end;*
*1 for correct pointers (if not as ms than clear and logical);* **2**

b The amount of memory taken up can vary;
// The size / length of the structure / linked list can vary; **1**

at run time; **1**

c A heap / stack/ a pool of available locations;
A pointer holds the address of the allocated block / next available location; **2** **8**

| | | | | |
|---|---|---|---|---|
| 2 | i | multi-tasking; | **1** | |
| | ii | multi-programming; | **1** | |
| | iii | multi-user; | **1** | **3** |

| | | | | |
|---|---|---|---|---|
| 3 | a i | 8; | | |
| | a ii | Each time a comparison is made in a binary search the number of items to be searched / list is halved; | **1** **1** | |
| | | *// 137 lies between $2^7$ and $2^8$;* Could give (ii) even if (i) incorrect | | |
| | bi | 137; | **1** | |
| | b ii | In a linear search of 137 items, the required item might be the 137th one; *need a termination – must explain why 137 is the <u>maximum</u>* | **1** | **4** |

| | | | | |
|---|---|---|---|---|
| 4 | a | command line interface; | **1** | |
| | b | command line interpreter / CLI; **A** shell *c and d must be in correct context* | **1** | |
| | c | user has access to all instructions – GUI can restrict access / can control hardware; CLI takes up less memory than a GUI / uses less processing power / No powerful graphics card required; Instructions execute faster than those given via a GUI / CLI is quicker to use for the experienced user than a GUI; Any two | **2** | |
| | d | The user has to remember the precise format of each instruction; Not intuitive / user friendly; *(less intuitive needs a than')* | **1** | **5** |

| | | | | |
|---|---|---|---|---|
| 5 | a i | 1011 1101 1001 0011; | **1** | |
| | ii | 1011101000 000011 –ve number; exponent +3; *(explained or demonstrated)* value $4\ ^3/_8$; Answer $-4\ ^3/_8$ / –4.375 1 mark for each of three points to max 3 | **1** **1** **1** | |
| | b | Normalisation ensures the maximum possible accuracy for a given number of bits*; (given no. of bits can be implied – e.g. leading zeroes can be replaced by significant digits at the end of the mantissa)* Arithmetic operations simplified Ensures that only a single representation of a number is possible; Any 2 points to max | **2** | **6** |

| | | | | |
|---|---|---|---|---|
| 6 | a | add; uses the rules 0+0=0, 0+1=1, 1+1=10; | **1** | |
| | | AND; uses the rules 0 AND 0 =0, 0 AND 1 = 0, 1 AND 1 = 1; | **1** | |
| | | // AND operates on a bit by bit basis; | **1** | |
| | | ADD carries out arithmetic between bits; | **1** | |
| | | // ADD performs addition, AND compares bits; | **1** | |
| | | AND outputs a 1 if both inputs are 1, otherwise 0; | **1** | |
| | b i | A register / the accumulator;<br>**A** general purpose register<br>**R** the wrong register e.g. MDR | **1** | |
| | ii | Access to main memory is slower than to a register;<br>Would need to write results to MM and read them back again for each instruction; | **2** | **5** |

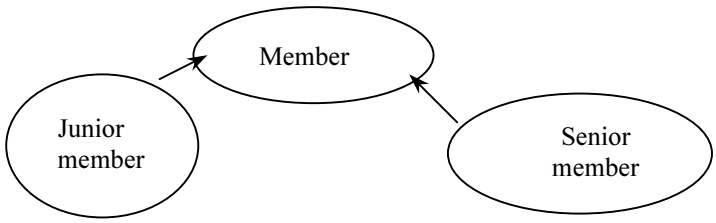
| | | | | |
|---|---|---|---|---|
| 7 | a | chris, clauses 10, 8 and 2; *at least 2 clauses needed*<br>alan clauses 11,4 and 1; *at least 2 clauses needed*<br>*names only, none,* | **1**<br>**1** | |
| | b | cousin (X,Y) IF grandfather (Z,X) AND grandfather (Z,Y);;;<br>*overall structure 'cousin(X,Y) IF grandfather () AND grandfather()' 1*<br>*(W,X) 1*<br>*(W,Y) 1*<br>*alternative approach mark in similar mode* | **3** | |
| | c | Processing of natural language;<br>Medical diagnosis;<br>Image interpretation;<br>Other valid types;<br>*1 mark for each of 2 valid suggestions to max*<br><br>**A** analysing family tree, Artificial Intelligence; | **2** | **7** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 8 | a | i | the operand field contains the data required for the operation; | | **1** | |
| | | ii | the operand refers to a location in main memory;<br>which holds the data required; | | **1**<br>**1** | |
| | | iii | the operand address is calculated by adding the value given;<br>to the contents of an index register; | | **1**<br>**1** | |
| | b | i | 0 | 5; | **1** | |
| | | ii | 120 | 5; | **1** | |
| | | ii | 121 | 5; | **1** | |
| | | iv | 127 | 5; | **1** | **9** |
| | | | | –1 mark if only changes filled in | | |

| | | | | | |
|---|---|---|---|---|---|
| 9 | a | Files are stored in separate directories / folders;<br>**A** path / pathway | | **1** | |
| | b | disk stores a disk map to indicate free and used blocks / FAT;<br>disk stores information such as disk volume name / label/ capacity of disk / number of sectors;<br>boot sector / messages;<br>disk stores directories for disk / contains system files;<br>Any 2 points @ 1 each | | **2** | |
| | c | *n.b. loading executable file* | | | |
| | | i | searches directory for match with given file name;<br>obtains a block address / uses FAT to locate file;<br>obtains size of file;<br>load file into memory;<br>checks file is compatible / not corrupted / no virus;<br>check file status (not already open, licensed)<br>*Any 2 @ 1 each* | **2** | |
| | | | *Error*: no matching file / invalid file name / file corrupt / file already opened / incompatible file type; | **1** | |
| | | ii | finds required amount of memory space / allocates memory;<br>loads into memory / co-ordinates sharing of memory (DLLs);<br>relocating loader translates addresses;<br>using size of file;<br>marks memory as taken / keeps track of where loaded;<br>allocates base and limit register values;<br>set up Page Management Table / **A** allocates segment descriptor table;<br>manages virtual memory;<br>*Any 3 @ 1 each* | **3** | |
| | | | *Error*: insufficient memory / memory full. | **1** | **10** |

10 a Produces re-usable code because of inheritance / encapsulation;
Data is only accessible in well defined ways (because encapsulated);
More efficient to write programs which uses pre-defined / inherited objects / classes;
*Storage structure of data and the code in an object may be altered without affecting programs that make use of the object;*
*Code produced contains fewer errors / more reliable;*
*Solutions are easier to understand when expressed in terms of objects;*
*Easier to enforce design consistency – Windows GUI functionality;*
*Cheaper production costs / Less maintenance effort required by developer since reliable 'objects' can be re-used / bought in;*
*New functions can be added to objects easily (because encapsulated);*
Any 2 advantages @ 1 each – must state an advantage, not make a statement. **2**
**R** Object is independent.

b




1 mark for correct base class and derived classes *;* **1**
1 for two correctly directed arrows; **1**

c Member = **Class**
(Procedure) AddNewMembers; }
(Procedure) AmendMembers; } ; **1**
(Procedure)ShowMembers; }
**Private** ; **1**
MembershipNo : Integer
Name : String;
Address : String; ;; **2** **8**
**End;**

*Exact syntax not required, but must be in style of .*
*3 procedures 1*
*Private 1*
*All 3 field (property) names 1*
*3 reasonable data types 1*