General Certificate of Education
June 2007
Advanced Subsidiary Examination

AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

COMPUTING   **CPT1**
**Unit 1   Computer Systems, Programming
            and Networking Concepts**

Tuesday 22 May 2007   9.00 am to 10.30 am

You will need no other materials.
You may use a calculator.

Time allowed: 1 hour 30 minutes

Instructions
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- Show all your working.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The maximum mark for this paper is 65.
- The marks for questions are shown in brackets.
- The use of brand names in your answers will **not** gain credit.
- You are reminded of the need for good English and clear presentation in your answers.

CPT1

Answer **all** questions in the spaces provided.

1 (a) Define the term software. ....

....

(1 mark)

(b) **Table 1** shows a list of software types with an example.

Complete the entries in the table. All entries **must be different**.

Table 1

Software category	Example
Programming language translator	(i) ....
(ii)	Disk defragmenter
(iii)	A DLL file that is used by several applications programs
General purpose applications program	(iv) ....

(4 marks)

2 (a) Writing program code requires the programmer to use identifiers for variables and procedures.

(i) State **two** other uses for identifiers.

1 ....

2 ....

(2 marks)

(ii) Most programming languages impose restrictions or rules about what is and is not allowed for identifier names. State **one** such rule.

....

(1 mark)

(b) Program code is often written with the use of procedures. Describe **one** reason why a programmer would decide to use procedures.

....

....

(1 mark)

(c) A programmer-written function **SearchThisArray** is defined as follows.

```
SearchThisArray(ThisArray : Array[1..10] Of String;
                            ThisString : String) : Integer ;
```

The function searches the array **ThisArray** for the value **ThisString**.

If an exact match is found, the function returns the index position in ThisArray.
If not found, the function returns -1.
If the function's arguments, ThisArray and ThisString are illegally formed, the function returns -2.

The function is used in a program with the statements shown below and uses the data shown in the Customer array in **Figure 1**.

Figure 1

Index (Subscript)	Customer
[1]	Weeks
[2]	Adamson
[3]	Patel
[4]	Berkovic
[5]	Ince
[6]	Neale
[7]	Williamson
[8]	Collins
[9]	Davis
[10]	Beckham

What is the value returned to variable Result in each case?

(i) `Result := SearchThisArray(Customer, 'Beckham')`

Value of Result ....

(1 mark)

(ii) `Result := SearchThisArray(Customer, 'Williams')`

Value of Result ....

(1 mark)

6

Turn over ▶

3 A county has a number of local libraries in various towns. Books currently belong to each library and there is no system for the exchange of books between libraries.
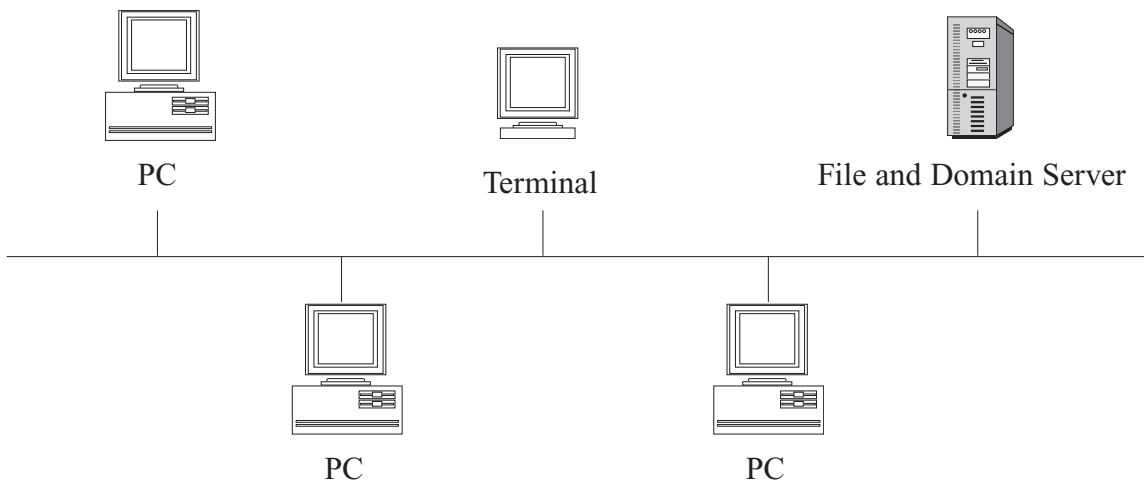
Each library has a local area network (LAN) for lending and enquiries shown in **Figure 2**.

(a) (i) Describe what is meant by a local area network.

....

....

(2 marks)

Figure 2

| PC | Terminal | File and Domain Server |

PC   PC

(ii) What type of local area network topology is shown in **Figure 2**?

....

(1 mark)

(iii) Does the network cable for this type of network use serial or parallel transmission of data?

....

(1 mark)

(iv) Name **one** other type of local area network topology.

....

(1 mark)

(v) Name **two** other devices which could be added to the network each of which would be a resource shared by users (administrators and/or borrowers) of the network.

1 ....

2 ....

(2 marks)

(b) There is currently an Internet connection from one of the PCs, and staff use this to contact a book supplier by keying the following into the address bar of the browser software.

http://www.bargainbooks-r-us.co.uk/index.htm

(i) What is the **domain name** of the supplier?

....

(1 mark)

(ii) What is **index.htm**?

....

(1 mark)

(iii) Sometimes when the browser is used the software displays the error message 'Page Not Found'.

Give **one** possible reason for this, other than a misspelling of the URL.

....

....

(1 mark)

(c) The decision has been made to connect each library to a wide area network.

(i) Explain what is meant by a wide area network (WAN).

....

....

(2 marks)

(ii) Describe **two** benefits of connecting all the libraries to a WAN. **One** should be a benefit for a library administrator, and **one** a benefit for a borrower.

1 Administrator ....

....

2 Borrower ....

....

(2 marks)

14

Turn over ▶

4 This question continues with the library service scenario from Question 3. New programs have to be written, as the decision has been made to have centralised records of library books.

The software house commissioned to write the new programs has obtained a complete list of titles held at each library. It found that a common system was used for the book codes. Some older books will not be retained and this is to be indicated by the `ToBeRetained` column in **Table 2**.

Table 2

BookTitle	BookCode	YearFirstInStock	ToBeRetained
Hang-gliding made simple	T05320	1993	
Around the world in 80 days	T76542	2001	
My way	M11981	1990	
Starting with hypnotherapy	M79080	2005	
Kim Smith – the autobiography	M00876	1991	
XXX			

(a) Study the sample data shown in **Table 2**. This data will be accessed by program code. Name the most suitable **data type** which should be used for each data item. Each data type **must be different**.

  (i) `BookCode` ....

(1 mark)

 (ii) `YearFirstInStock` ....

(1 mark)

(iii) `ToBeRetained` ....

(1 mark)

(b) The first application to be developed is a program to search the complete list of books and to calculate the data values for the `ToBeRetained` column; any books which were bought before 1992 will not be retained.

The incomplete pseudo-code which follows shows a first attempt at the algorithm. Data for each of the four attributes `BookTitle`, `BookCode`, `YearFirstInStock`, `ToBeRetained` are shown in the table in **Table 2**, and are to be stored in four arrays `BookTitle`, `BookCode`, `YearFirstInStock` and `ToBeRetained`.

Complete the pseudo-code in the **three** places indicated.

```
        For Book ← 1 To TotalNoOfBooks

          If YearFirstInStock[ (i) .................................. ] < 1992

              Then ToBeRetained[Book]  ←(ii) ..................................

              Else ToBeRetained[Book]  ←(iii) ..................................

          EndIf

        EndFor
```

(3 marks)

(c) A second program is to be developed to allocate each book a new code number. The old book codes are to be abandoned. The first character of the old book code indicates the book's location.

- This book location is to be retained and stored in an array `Location`.
- Each new book code will be a unique integer number that will be generated by the program. The first number will be 1.

Use will be made of a 'built-in' function `StartString`. It is defined in the help files as follows:

```
Function StartString(ThisString : String; NoOfCharactersToRetain : Integer) :
String ;
```

The function is given the string **ThisString** and returns the number of characters specified by **NoOfCharactersToRetain** starting from the first character of **ThisString**.

(i) What are the values of the **parameters** used in the following code?

```
NewString := StartString('T76542', 1)
```

1 ....

2 ....

(2 marks)

(ii) What value is assigned to `NewString` when this code is executed?

....

(1 mark)

Question 4 continues on the next page

Turn over ▶

(iii) The pseudo-code for the algorithm to calculate the new book codes and the locations is shown below.

```
NextAvailableCode ← 1
Book ← 1
Repeat
   If YearFirstInStock[Book] >=1992
     Then
       Begin
         LocationLetter ← StartString(BookCode[Book], 1)
         If LocationLetter = 'T'
             Then Location[Book] ← 'Torrington'
         If LocationLetter = 'M'
             Then Location[Book] ← 'Morristown'

         NewCode[Book] ← NextAvailableCode
         NextAvailableCode ← NextAvailableCode + 1
       End

   Book ← Book + 1
Until BookTitle[Book] = 'XXX'
```

Trace the execution of this algorithm by completing the trace table **Figure 4**; use the data shown in the table **Figure 3**.

Show also the final contents of the `Location` and `NewCode` arrays in **Figure 5** and **Figure 6**.

Figure 3

	BookTitle		BookCode		YearFirstInStock
[1]	Hang-gliding made simple	[1]	T05320	[1]	1993
[2]	Around the world in 80 days	[2]	T76542	[2]	2001
[3]	My way	[3]	M11981	[3]	1990
[4]	Starting with hypnotherapy	[4]	M79080	[4]	2005
[5]	Kim Smith – the autobiography	[5]	M00876	[5]	1991
[6]	XXX	[6]		[6]	

Figure 4

NextAvailableCode	Book	LocationLetter
1	1	'T'

Figure 5

Location

[1]
[2]
[3]
[4]
[5]

Figure 6

NewCode

[1]
[2]
[3]
[4]
[5]

(6 marks)

15

Turn over for the next question

Turn over ▶

5 (a) State the principle of operation of a set of data values which behave as a stack.

....

....
(1 mark)

(b) Memory locations 600 to 605 are to be used as a stack area to store character data, and the first value added to the stack is to be stored at address 600.

Figure 7

600	
601	
602	
603	
604	
605	

Figure 7 shows the initial empty state of the stack.

Figure 8

600	
601	
602	
603	
604	
605	

(i) Show on **Figure 8** the state of the stack after the characters 'A', 'V', 'E', 'R' and 'Y' join the stack.
(1 mark)

Figure 9

600	
601	
602	
603	
604	
605	

(ii) Two items are removed from the stack. Show on **Figure 9** the state of the stack.
(1 mark)

Figure 10

600	
601	
602	
603	
604	
605	

(iii) Two new characters 'S' and 'P' join the stack. Show on **Figure 10** the final state of the stack.
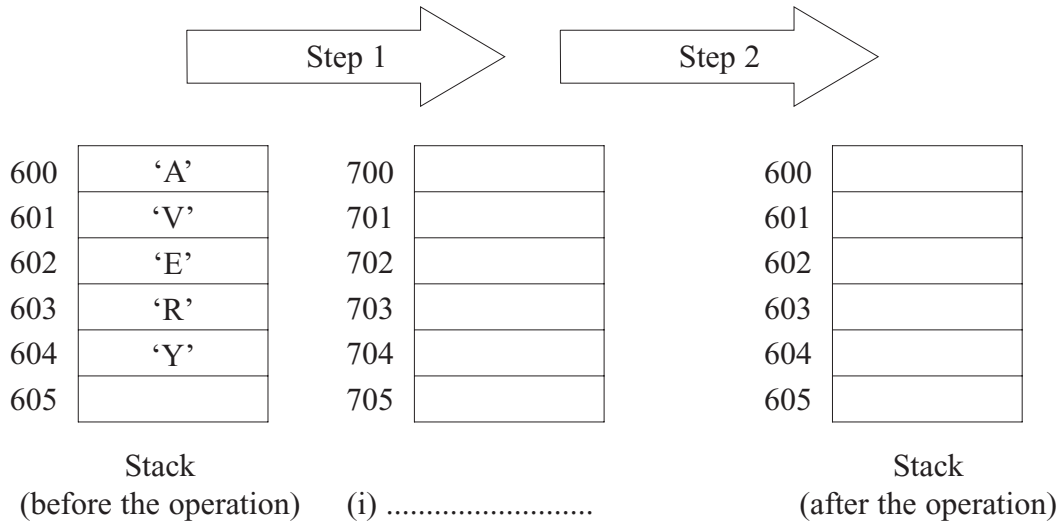*(1 mark)*

(c)   The original items in this stack are to be reversed. This can be done using a second data structure which uses locations 700 to 705 respectively. The first item added to the stack was character 'A'.

Figure 11

600	'A'
601	'V'
602	'E'
603	'R'
604	'Y'
605	

Stack
(before the operation)

700	
701	
702	
703	
704	
705	

(i) ....

600	
601	
602	
603	
604	
605	

Stack
(after the operation)

(i)   Name the second data structure. Label **Figure 11**.

(1 mark)

(ii)   Describe **Step 1** in **Figure 11**.

....

....

(1 mark)

(iii)   Describe **Step 2** in **Figure 11**.

....

....

(1 mark)

(iv)   Show on **Figure 11** the final contents of all the memory locations.

(2 marks)

Turn over for the next question

Turn over ▶

9

6 A programming language has two different data types for storing positive integers.

Data type Integer1 uses a single byte to store data.
Data type Integer2 uses two consecutive bytes to store data.

(a) The program statement below defines a variable NoOfAccidents.

```
Var NoOfAccidents : Integer1 ;
```

What is the largest value which can be assigned to NoOfAccidents?

....
(1 mark)

(b) Two more program statements are:

```
Var JourneyMileageA : Integer1 ;
Var JourneyMileageB : Integer1 ;
```

Interpreter software uses address 600 for storing a value for JourneyMileageA. See **Figure 12**.

(i) State the **denary value** for the stored binary value.

Figure 12

JourneyMileageA = ...
(1 mark)

(ii) The program statement:

```
JourneyMileageB := 138 ;
```

stores the data value for JourneyMileageB at address 603.

What **binary value** will be stored at location 603?

....
(1 mark)

Address	Contents
600	0101 0001
601	1010 1010
602	1111 1100
603	
604	
~	~
~	~
700	0000 0010
701	0000 1010
702	
703	

(c) Another program statement is:

```
Var TotalMileage : Integer2 ;
```

The interpreter software uses locations 700 and 701 to store a value for TotalMileage with the most significant byte stored at location 700. See **Figure 12**.

What is the **denary value** assigned to TotalMileage?

....
(1 mark)

(d) Programs also work with character data.

Table 3

ASCII Code Table

Character	Decimal	Character	Decimal	Character	Decimal
<space>	32	I	73	R	82
A	65	J	74	S	83
B	66	K	75	T	84
C	67	L	76	U	85
D	68	M	77	V	86
E	69	N	78	W	87
F	70	O	79	X	88
G	71	P	80	Y	89
H	72	Q	81	Z	90

(i) Using the ASCII code table shown in **Table 3**, what is the **7-bit binary ASCII code** for character 'B'?

....

(1 mark)

(ii) When a parity bit is included, character codes are stored as 8-bit binary numbers where the most significant bit is a parity bit. This system will use **even parity**.

Describe how the parity bit is used during data transmission of a single character.

....

....

....

(2 marks)

7

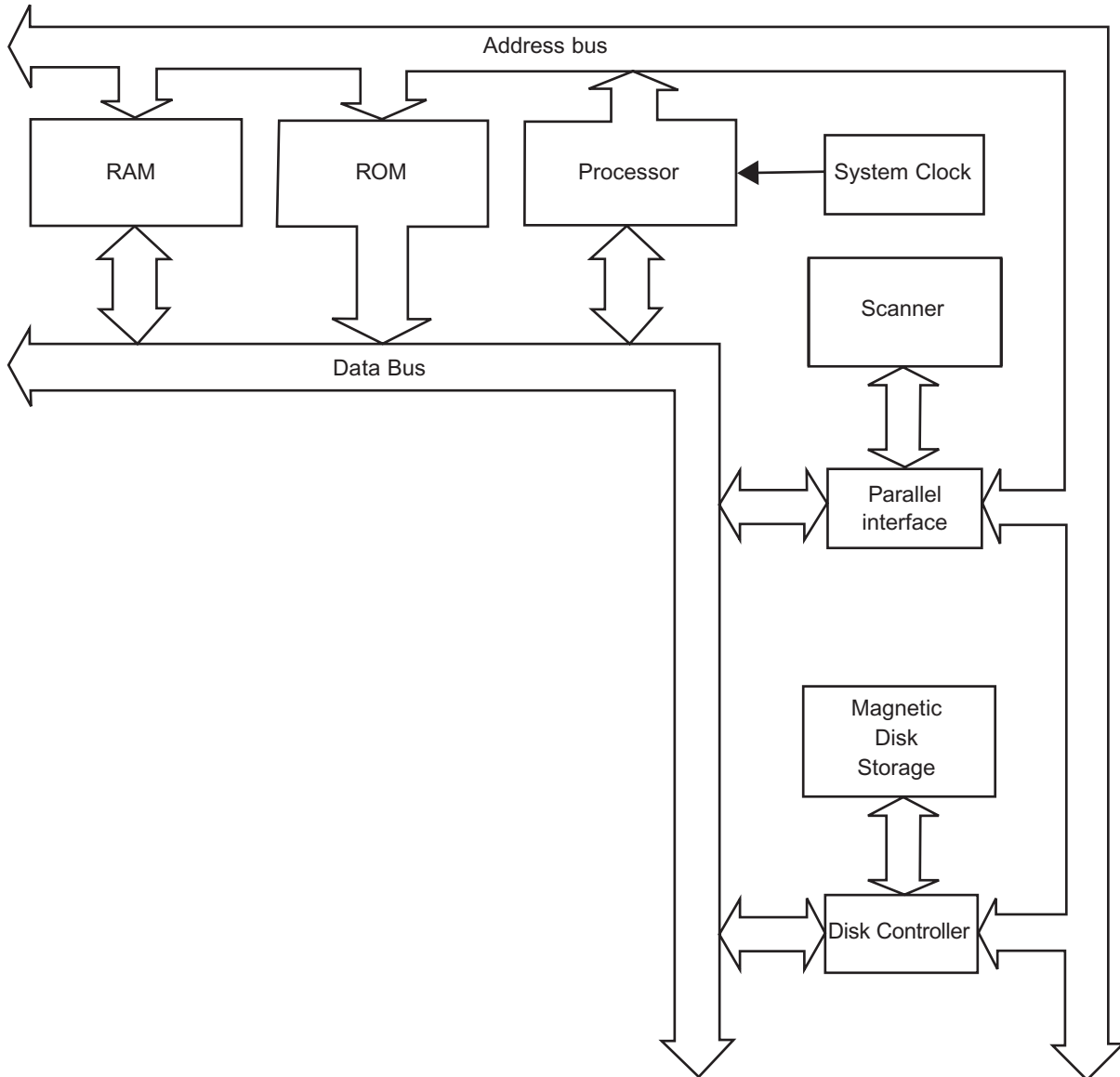**Turn over for the next question**

7 **Figure 13** shows an incomplete diagram of a typical computer system architecture.

Figure 13

(a) Two of the components shown in **Figure 13** for a typical PC, are the RAM and the Magnetic Disk Storage. Select from the list below a typical specification value for each component.

300 GB   2 MHz   1 GB   128 kbps   3.0 MHz

(i) RAM ....

(1 mark)

(ii) Magnetic Disk Storage ....

(1 mark)

(b) A third bus has been omitted from the diagram in **Figure 13**.

Name this bus. ....

(1 mark)

(c) Explain why the data bus is bi-directional, but the address bus is one-way only.

....

....

....

....

(2 marks)

(d) The processor performs different types of operations; for example, arithmetic operations.

Name **one** other type of operation. ....

....

(1 mark)

(e) Explain the **stored program concept**. ....

....

....

....

(3 marks)

9

END OF QUESTIONS

There are no questions printed on this page