General Certificate of Education
January 2008
Advanced Subsidiary Examination

AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

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

Monday 14 January 2008   1.30 pm to 3.00 pm

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.

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

1 **Table 1** lists some components of a computer system. Put **one** tick on each row to describe each component as either:

- software
- hardware
- hardware and software.

Table 1

Component	Software	Hardware	Hardware and Software
An application program			
A printed circuit board which controls the wash programme inside a washing machine			
Main memory chips in the PC			

(3 marks)

2 You want to improve the performance of your PC by upgrading certain components, whilst retaining the same motherboard.

What upgraded/additional components would bring about the following improvements? Your components for parts (a), (b) and (c) **must** be different.

(a) Increasing the speed at which application programs are executed.

Component: ....

Explanation: ....

....
(2 marks)

(b) Avoiding the need to continually archive picture and music files to CD storage.

Component: ....

Explanation: ....

....
(2 marks)

(c) Having several additional devices connected at the same time to your computer. For example, a digital camera and memory card reader.

Component: ....

Explanation: ....

....
(2 marks)

3

6

3 **Figure 1** shows a very small part of a sound wave recorded through a microphone connected to a computer.

Figure 1
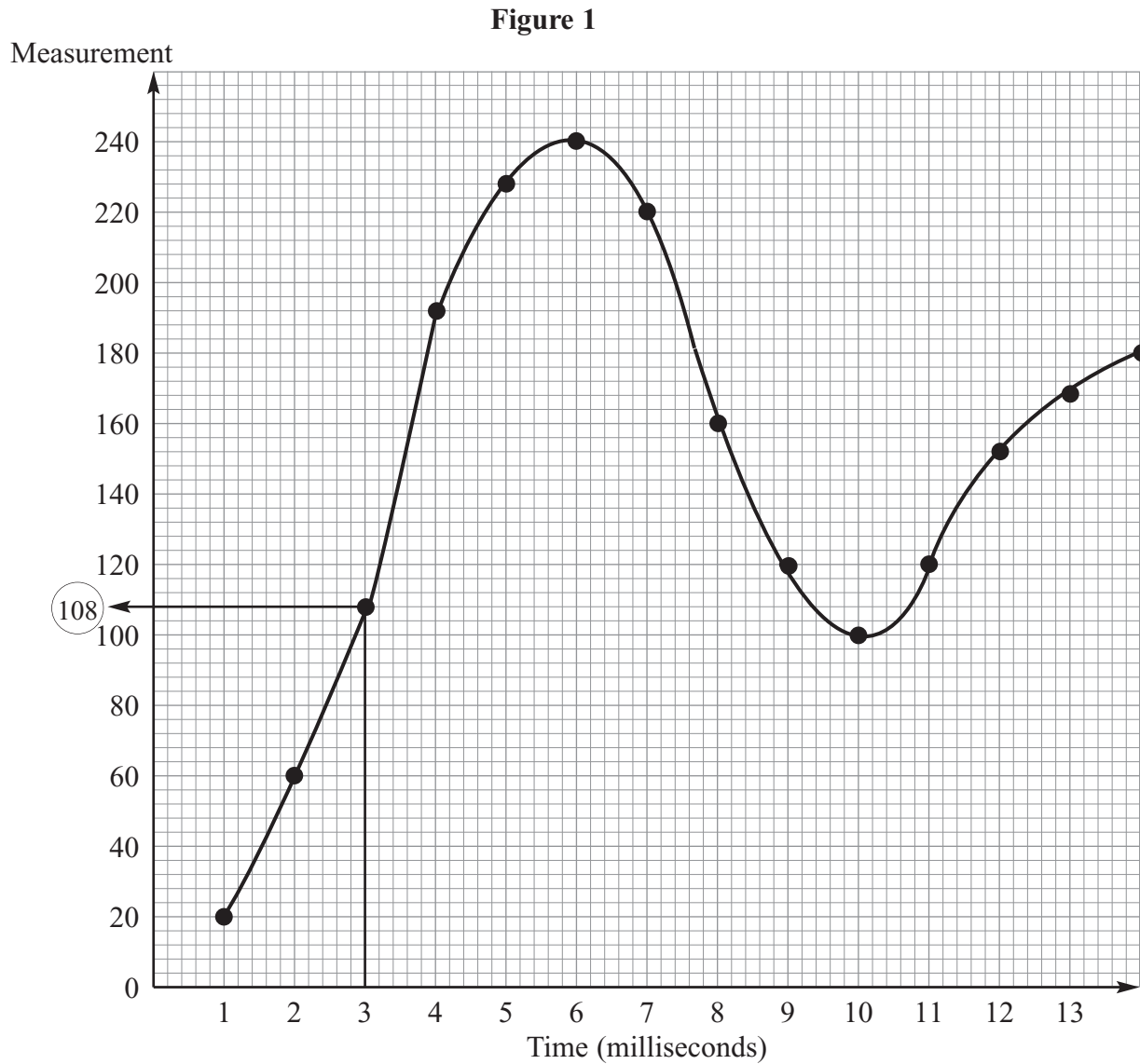
Measurement

The dots each represent a recorded measurement of the sound wave. The recorded measurements are stored in main memory shown in **Table 2**, with the first measurement stored in main memory location 700.

Question 3 continues on the next page

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Table 2

Memory Address	Measurement
700	0001 0100
701	0011 1100
702	(e)
703	1011 1101
704	1110 0011
705	1111 0000
706	1101 1100
707	1010 0000
708	0111 0111
709	0110 0100

(a) Name **two** items of essential software which **must** be in the main memory at the time this recording process takes place.

1 ....

2 ....

(2 marks)

(b) (i) Explain what is meant by the **sampling rate**.

....

(1 mark)

(ii) Study **Figure 1** and state what the sampling rate is for this recording.

(1000 milliseconds = 1 second).

....

(1 mark)

(c) Study **Table 2**. How many bits are allocated to each sample?

....

(1 mark)

(d) (i) State **one** advantage of increasing the number of bits allocated to each sample.

....

(1 mark)

(ii) State **one** disadvantage of increasing the number of bits allocated to each sample.

....

(1 mark)

(e)   Study **Figure 1**. What will be the binary value stored at location 702 shown in **Table 2**?

....
(1 mark)

(f)   In **Table 2** each of the binary values represents part of a sound file.
Give **three** other possible interpretations of one or more bytes held in main memory
when the computer is being used for any application (excluding part of a picture or
other media file).

1 ....

2 ....

3 ....
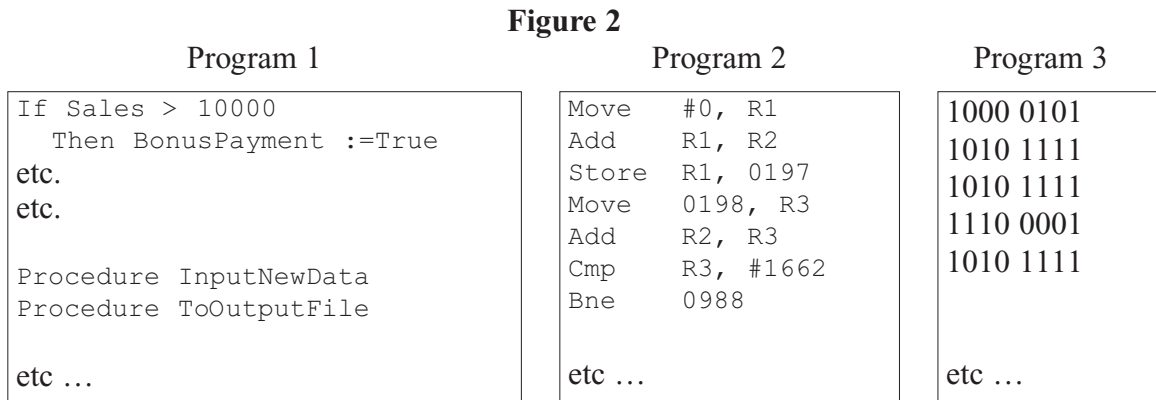*(3 marks)*

11

Turn over for the next question

Turn over ▶

4 **Figure 2** shows three different programs which have been developed using different generations of programming language.

Figure 2

Program 1

```
If Sales > 10000
   Then BonusPayment :=True
etc.
etc.


Procedure InputNewData
Procedure ToOutputFile

etc …
```

Program 2

```
Move    #0, R1
Add     R1, R2
Store   R1, 0197
Move    0198, R3
Add     R2, R3
Cmp     R3, #1662
Bne     0988

etc …
```

Program 3

```
1000 0101
1010 1111
1010 1111
1110 0001
1010 1111


etc …
```

The above programs were written for different tasks.

(a)   What generation of programming language was used for Program 1?

....
(1 mark)

(b)   Indicate which program was most likely to have been written for:

(i)   controlling a new hardware device.

....
(1 mark)

(ii)   a payroll application.

....
(1 mark)

(c)   Program 1, Program 2 and Program 3 may require translation before each can be executed.

Table 3

	Assembler	**Compiler**	**None**
Program 1			
Program 2			
Program 3			

Put **one** tick on each row in **Table 3** to indicate the translator software required.

(3 marks)

(d) Describe how **interpreter** software enables a program written in a high level language to be executed.

....

....

....
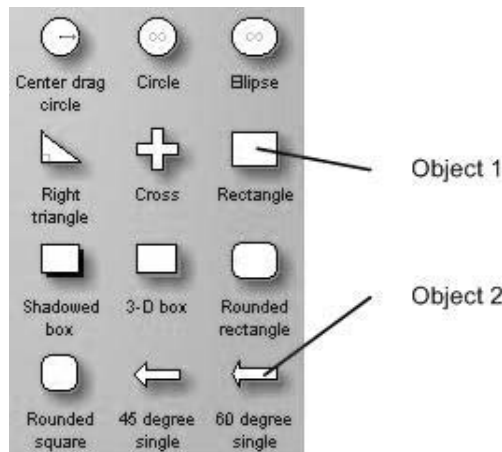*(2 marks)*

(e) A friend gives you a copy of a freeware **assembler**. Why might you not be able to use this successfully on your computer?

....

....
(1 mark)

9

5 (a) **Figure 3** shows some of the drawing objects available with a vector graphics drawing software package.

Figure 3

(i) Name **two properties** which are common to Object 1 and Object 2.

1 ....

2 ....
(2 marks)

(ii) When a designer creates a drawing, the size of various objects is often increased/decreased/moved as the drawing is being developed.

Explain why no distortion occurs in vector graphics when the size of various objects is changed.

....

....
(2 marks)

Turn over ▶

(iii) With vector graphics software, each new drawing is created as a set of vectored objects. Each drawing is created and saved in a file format specific to that brand of software. The software has an 'export' facility so that a bitmapped version of any drawing can be produced which can then be used as appropriate e.g. included in a word processed document.

Why is this arrangement preferable to bitmapped-based software which only creates and saves a bitmapped file?
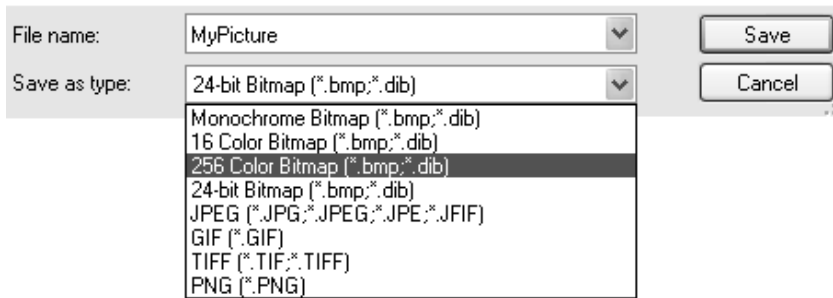
....

....
(1 mark)

(b) Bitmapped software saves the picture as pixels, with a range of different possible colour resolutions as shown in **Figure 4**.

Figure 4

(i) If the graphic is saved as shown as a '256 color bitmap', how many bytes will be used to store each pixel?

....
(1 mark)

(ii) A picture is downloaded from a camera-phone and saved as a '256 color bitmap'. The picture has a width of 1280 pixels and height 768 pixels.

What is the file size in Kilobytes?

....
(1 mark)

(iii) The same picture as in part (ii) is later loaded into bitmapped software on a PC and saved to a new file as a '16 color bitmap'.

What is the size of this file in Kilobytes?

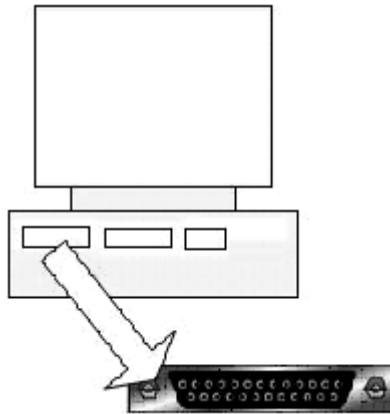...
(1 mark)

6 (a) State what is meant by **serial transmission** of data.

....

....
(1 mark)

Figure 5

(b) (i) **Figure 5** shows a port on the back of a PC which is used for the **parallel transmission** of data; typically between the PC and a printer.

More than eight of the port lines are used during a data transfer.

State **two different** uses for the lines.

1 ....

2 ....
(2 marks)

(ii) When would it be **inappropriate** to use parallel data transmission, even when the communicating device has a parallel port?

....

....
(1 mark)

(c) Define **asynchronous data transmission**.

....

....
(1 mark)

Turn over ▶

5

7 Cars over three years old have to pass a roadworthy test called the MOT. Various categories are tested and for this question they have been simplified to:

- Brakes
- Steering
- Tyres
- Bodywork.

A car passes the MOT test – in this simplified scenario – if it passes all four categories.

Data for a single car is stored as a string consisting of the digit characters '0' and '1' e.g. '1110'.

- '1' denotes a category pass

- '0' denotes a category fail.

The order of the categories is as shown above. For example, the data '1110' describes a car which passed on brakes, steering and tyres, but failed on bodywork.

The built-in function `SingleCharacter` is to be used in the algorithm which follows, and is described in the help files as follows:

```
SingleCharacter(ThisString : String; ThisPosition : Integer) : Char ;
```

Returns the single character at position `ThisPosition` in the string `ThisString`.

E.g. `Result := SingleCharacter('1110', 4)` would return and assign '0' to `Result`.

The following incomplete algorithm is designed to calculate whether a single car has passed or failed.

The identifier list for variables used by the algorithm is shown in **Table 4**.

(a) Complete **A**, **B** and **C** in the algorithm.

```
CarFailed ← False
Input NextCar
For Position ← 1 To 4
   Do NextCategory ← SingleCharacter ( A ........................... , B ........................... )
      If C .........................................................
         Then CarFailed ← True
      End If
End For


If CarFailed = False
   Then Output 'Car passed MOT'
   Else Output 'Car failed MOT'
End If
```

(3 marks)

(b) Complete the data types and comment – **D**, **E** and **F** – in **Table 4**.

The data types should be selected from those shown in **Table 5**.

Table 4

Variable	Data Type	Comment
Position	**D**	**E** ....
NextCar	String	Data for a single car
NextCategory	**F**	Data for a single category
CarFailed	Boolean	Result indicator

(3 marks)

Table 5

Data type	Explanation
Integer	Whole number
Real	Number with a fractional part
String	Zero or more characters
Char	Single character
Boolean	True/False values only

Turn over ▶

6

8 (a) A computer system uses **two bytes** to store **pure binary integer numbers**.

Show the bit pattern used to represent the denary number 265.

(1 mark)

(b) The computer system also stores **BCD numbers** using **two bytes**.

(i) Show the BCD bit pattern for the denary number 195.

(1 mark)

(ii) The following is not a valid BCD representation. Explain why.

1	0	0	0	0	0	0	1	1	0	1	0	0	1	0	0

....

(1 mark)

3

9 A binary search tree is used by software to store and then search for user names on a College network.

The following are the first seven user names to join the tree:

   PollardJ, AtkinsP, RogersG, AbbottJ, SearleF, CollinsK, RuddleA

(a) Sketch the tree structure.

(2 marks)

(b) The tree is to be searched for various user names.

   (i)   The task is to search for the user name **CollinsK**. List in order the nodes visited.

   ....
   (1 mark)

   (ii) A second search is done to find the user name **RuddleA**. How many comparisons does this require?

   ....
   (1 mark)

Turn over for the next question

4

Turn over ▶

10 A firm selling double glazing employs three sales staff. Each person is given a sales target for each of the four quarters of the year.

- Quarter 1   January – March
- Quarter 2   April – June
- Quarter 3   July – September
- Quarter 4   October – December

Based on all the sales made, the data in **Table 6** is produced showing whether or not each sales person achieved their target sales for each quarter. Each value is stored as a single character 'Y' (sales target met) or 'N' (sales target not met).

The columns represent each quarter, each row represents a salesperson.

Table 6

Target

	[1]	[2]	[3]	[4]
[1]	Y	N	Y	N
[2]	N	N	**Y**	Y
[3]	N	N	N	N

(a) What data structure could be used in a programming language for organising the data shown in **Table 6**?

....
(1 mark)

(b) One of the data values in **Table 6** has been emboldened. What does this value represent?

....
(1 mark)

(c) The following algorithm processes the data shown in **Table 6**. Trace the execution of the algorithm by completing **Table 7**.

```
For Quarter ← 1 To 4
   Do NewArray[Quarter] ← 0
End For

For Person ←1 To 3
   Do
     For Quarter ← 1 To 4
        Do
           If Target[Person, Quarter] = 'N'
             Then NewArray[Quarter] ← NewArray[Quarter] + 1
           End If
        End For
   End For
End For
```

Table 7

Person	Quarter	Target[Person, Quarter]	NewArray [1]	[2]	[3]	[4]
	1					

(6 marks)

(d) Explain what numbers are being calculated and stored in the NewArray data structure.

....

....

(2 marks)

10

END OF QUESTIONS

There are no questions printed on this page

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