version 1.1

General Certificate of Education
Advanced Level Examination
June 2009

COMPUTING COMP1

Unit 1 Problem Solving, Programming, Data Representation and Practical Exercise

Specimen paper for examinations in June 2010 onwards
This question paper uses the new numbering system

For this paper you must have:
- access to the Electronic Answer Document
- a copy of the Preliminary Material

You must **not** use a calculator.

Time allowed
- 2 hours

Instructions
- Type your answers into the Electronic Answer Document.
- Enter the information required on the front of the Electronic Answer Document.
- Answer **all** questions.
- You will need access to:
  - a computer
  - a printer
  - appropriate software
  - the electronic version of the Skeleton Program and Data File.
- Before the start of the examination make sure your **Centre Number, Candidate Name and Number** are shown clearly in the footer of the Electronic Answer Document (not the front cover).

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.
- No extra time is allowed for printing and collating.
- The question paper is split into four sections.
  You are advised to spend time on each section as follows:
  Section A – 25 minutes
  Section B – 20 minutes
  Section C – 20 minutes
  Section D – 55 minutes

At the end of the examination
- Tie together all your printed Electronic Answer Document pages and hand them to the invigilator.

Warning
- It may not be possible to issue a result for this unit if your details are not on every page.

Section A

You are advised to spend no more than **25 minutes** on this section.

Type your answers to Section A in your Electronic Answer Document. You **must save** this document at regular intervals.

Question 1

Bitmapped graphic images are composed of **pixels**.

0 1 State what is meant by a pixel.

(2 marks)

`

Any black and white image will require only a single bit to encode each pixel.
Figure 1 shows a black and white bitmapped image.
Figure 2 shows the memory locations where the image is stored.
The first byte used for the pixel data is at location 187.
The pixel data are stored row-by-row, starting with row 1:

- black pixels are encoded with the bit set to `1`
- white pixels are encoded with the bit set to `0`.

Figure 1

Row	1	2	3	4	5	6	7	8	9	10	11	12	12	14	15	16
1			■	■	■			■			■		■			
2			■		■		■		■		■	■	■			
3			■				■		■		■		■			
4			■				■		■		■		■			
5			■				■		■		■		■			
6			■		■		■		■		■		■			
7			■	■	■			■			■		■			

Figure 2

Location	Contents
187	`0011 1001`
188	`0010 1000`
189	
190	
: : :	
200	`0010 1000`

0 2 What will be the contents of location 189 in **binary**?

Use the grid for rough working, then copy the bit pattern to your Electronic Answer Document.

(1 mark)

0 3 What will be the contents of location 190 in **denary**?

(1 mark)

Colour images can also be encoded as bitmaps.

0 4 Explain how the colour of each pixel is encoded.

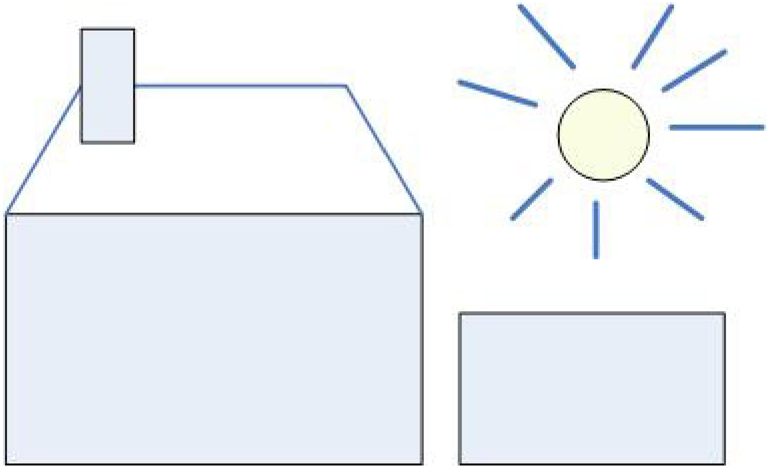
(1 mark)

0 5 How many bits are required to store each pixel for a 256-colour image?

(1 mark)

The image in **Figure 3** was created with a vector graphics program.

Figure 3



0 6 Describe how a vector graphics program stores the data about the image.

(2 marks)

0 7 Name **three** properties that would be stored for a circle object.

(3 marks)

Question 2

Computer programs process and store numeric data.

A computer game stores the following data:

- **level of difficulty** as an integer in the range 1 to 15
- **player rating** as an integer in the range -120 to +120
- **fuel level** as a number with a fractional part.
  This number is in the range 0 to 100

The level of difficulty is stored as an **unsigned binary number** using a single byte.
For a particular game, the level of difficulty was set at 11.

0 8 Calculate its binary value.

Use the grid for rough working, then copy the bit pattern to your Electronic Answer Document.

(2 marks)

A player rating value is stored as a **two's complement integer** using a single byte.

0 9 Convert the player rating value of 119 into binary.

Use the grid for rough working, then copy the bit pattern to your Electronic Answer Document.

(1 mark)

1 0 Convert the player rating value of -13 into binary.

Use the grid for rough working, then copy the bit pattern to your Electronic Answer Document.

(2 marks)

A fuel level value is stored as an **unsigned fixed point number** using **two bytes** with **four bits** after the binary point.

1 1 Convert the fuel level value of 25.75 into binary.

Use the grid for rough working, then copy the bit pattern to your Electronic Answer Document

											●				

(3 marks)

Question 3

A **state transition diagram** models the operation of a hotel lift. A program is written to simulate the behaviour of the lift in a hotel.

1 2 Describe **three** states that should be present in this diagram.

(3 marks)

Figure 4 shows a state transition diagram for a problem, which has two states S1and S2.

Figure 4

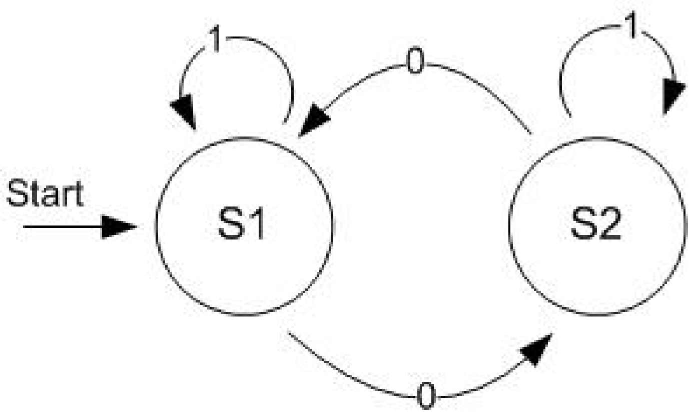


Table 1 is a state transition table for **Figure 4**. The **Next State** column is incomplete.

Type the states for 13, 14 and 15 in your Electronic Answer Document.

1 3
1 4
1 5

Table 1

Input	Current State	Next State
0	S1	S2
0	S2	**13**
1	S1	**14**
1	S2	**15**

(3 marks)

Section B

You are advised not to spend more than **20 minutes** on this section

Type your answers to Section B in your Electronic Answer Document.
You **must save** this document at regular intervals.

The question in this section asks you to write program code **starting from a new program/project/file**.

- Save your program/project/file in its own folder/directory.
- You are advised to save your program at regular intervals.

Question 4

Create a folder/directory **Question4** for your new program.

The variable table, **Table 2**, and the Structured English algorithm describe a simplified version of the **Guess the Word/Phrase Game**.

Table 2

Identifier	Data Type	Purpose
`NewWord`	`String`	Stores the setter's word to be guessed
`UserWordGuess`	`String`	Stores a word that is the user's guess

```
OUTPUT "The new word?"
INPUT NewWord
OUTPUT "Your guess?"
INPUT UserWordGuess
IF UserWordGuess IS EQUAL TO NewWord
  THEN OUTPUT "CORRECT"
  ELSE OUTPUT "INCORRECT"
ENDIF
```

What you need to do

Write a program for the above algorithm in the programming language of your choice.

Test the program as follows.

Test 1: Input of the new word EAGLE followed by a correct guess.
Test 2: Input of the new word BEAR followed by an incorrect guess.

Save the program in your new **Question4** folder/directory.

Evidence that you need to provide

Include the following in your Electronic Answer Document.
SCREEN CAPTURES for the following tests:

1	6	Test 1	*(3 marks)*
1	7	Test 2	*(3 marks)*
1	8	Your PROGRAM SOURCE CODE.	*(7 marks)*

Section C

You are advised to spend no more than **20 minutes** on this section

Type your answers to Section C in your Electronic Answer Document. You **must save** this document at regular intervals.

These questions refer to the **Preliminary Material,** but do **not** require any additional programming.

Refer either to the **Preliminary Material** issued with this question paper or your electronic copy.

Question 5

This question is about the structure and content of the **Skeleton Program.**

1 9 Give **three** reasons why this Program has been structured with procedures/functions.
(3 marks)

The following questions are all about the identifiers used in the Pre-release Program.

State the name of an identifier name used for:

2 0 a local variable;
(1 mark)

2 1 a global variable;
(1 mark)

2 2 a pre-defined function with a single parameter;
(1 mark)

2 3 an array variable;
(1 mark)

2 4 a variable that is used to control the iteration of a loop;
(1 mark)

2 5 a user-defined (i.e. programmer-defined) procedure/function that only produces output to the screen.
(1 mark)

2 6 State the name of a user-defined procedure/function that has one or more parameters.
(1 mark)

2 7 Name the parameter(s).
(1 mark)

The design and implementation of the **Skeleton Program** includes one validation check on the word or phrase that is input by the user.

2 8 Describe this validation check.

(3 marks)

Study the code for the function `GetNewPhrase`.

2 9 What is the condition that controls the execution of the loop?

(1 mark)

3 0 What will be the outcome if the setter continually keys in a word/phrase which fails the validation test?

(1 mark)

Procedure `SetUpGuessStatusArray` uses a `For` loop.

3 1 Why is a loop needed?

(1 mark)

3 2 Why was a `For` loop chosen?

(1 mark)

3 3 What determines the number of iterations for a given input word/phrase?

(1 mark)

Question 6

This question requires **no coding**. The **Skeleton Program** does not store every letter guess made by the user.

Page 7 of the **Preliminary material** contains two designs, labelled **Suggestion 1** and **Suggestion 2** for storing **every** letter guess.

Study **Suggestion 1.**

3 4 The user makes four guesses, `'B'`,`'E'`,`'F'`,`'J'` in that order.

State the array positions where contents have changed. What do these cells now contain?

(5 marks)

3 5 Will the stored data change if the user then enters `'F'` again, by mistake?

(1 mark)

Study **Suggestion 2**.

The user makes four guesses, `'C'`, `'G'`, `'B'`, `'H'` in that order.

3 6 State the array positions where contents have changed. What do these cells now contain?

(2 marks)

The user enters `'B'` again, by mistake.

3 7 State whether or not the `LettersGuessedArray` changes.

(1 marks)

3 8 Explain your answer to part 37.

(1 mark)

Turn over for the next section

Section D

You are advised to spend no more than **55 minutes** on this section

Put your answers to Section D in your Electronic Answer Document. You **must save** this document at regular intervals.

These questions require you to load the **Skeleton Program** and make programming changes to it.

Question 7

The menu currently provides the user with three choices (1, 2, and 5).

What you need to do

Make the following amendments to the **Skeleton Program**.

- Add another choice to the menu:
  `"3. USER - Make a complete word/phrase guess"`

- Add a new procedure/function `InputUsersCompletePhraseGuess`
  Code this procedure/function as a stub, which only displays the message:
  `"Procedure InputUsersCompletePhraseGuess has been called"`

- Add the code to call this procedure when menu choice 3 is selected.

Test that the program displays the correct message when menu choice 3 is selected.

Evidence that you need to provide

Include in your Electronic Answer Document:

3 9 Your amended PROGRAM SOURCE CODE for procedure/function `Display Menu`.
(2 marks)

4 0 Your PROGRAM SOURCE CODE for procedure/function `InputUsersCompletePhraseGuess`.
(3 marks)

4 1 The PROGRAM SOURCE CODE STATEMENT(S) that you have written to call procedure/function `InputUsersCompletePhraseGuess`.
(2 marks)

4 2 A SCREEN CAPTURE of the test showing that the procedure is called when menu choice 3 is selected.
(2 marks)

Question 8

You are required to change the solution. The phrase will not be set by the setter. Instead it will be selected at random and read from a stored file of phrases `MyPhrases.txt`. This file has one phrase per line, some of which are single words.

The file **MyPhrases.txt** is available in the **Preliminary Material** and should be accessible from your account.

What you need to do

Add code to the **Skeleton Program** to implement the tasks numbered 1 to 4 which follow.

Task 1 Provide a new menu choice: `"4. Run Question 8 code"`.

This will be used to run the new code created for the following tasks 2, 3 and 4.

Task 2 A procedure/function `CountPhrasesFromFile`.

The procedure/function must:

- open the file `MyPhrases.txt`
- read the contents of the file
- count the number of phrases and return this number. (A phrase can be a single word).

Evidence that you need to provide

Include in your Electronic Answer Document:

4 3 PROGRAM SOURCE CODE for the procedure/function `CountPhrasesFromFile`.

(7 marks)

Write code which calls the procedure/function `CountPhrasesFromFile` when menu choice 4 is selected.

Test that procedure/function `CountPhrasesFromFile` meets its specification.

Evidence that you need to provide

Include in your Electronic Answer Document:

4 4 A SCREEN CAPTURE for **one** test run of the program showing:
the total number of phrases in the file

(1 mark)

Task 3 A procedure/function `GenerateRandomPhraseNumber`.

The procedure/function must return a random integer between 1 and n, say x, where n is the number of phrases in the file `MyPhrases.txt`.
Use the programming language's random number generator.

Evidence that you need to provide

Include in your Electronic Answer Document:

4	5	PROGRAM SOURCE CODE showing the procedure/function `GenerateRandomPhraseNumber.`

(3 marks)

Change your code so that when menu choice 4 is selected your program calls procedures/functions:

- `CountPhrasesFromFile`
- `GenerateRandomPhraseNumber`.

Test that procedure/function `GenerateRandomPhraseNumber` meets its specification.

Evidence that you need to provide

Include in your Electronic Answer Document:

4	6	SCREEN CAPTURES for **two** test runs of the program each showing: x, the generated phrase number

(2 marks)

Task 4 A procedure/function `SelectPhraseFromFile`

The procedure/function must:

- open `MyPhrases.txt`
- read the x^{th} phrase
- return the phrase.

Test that procedure/function `SelectPhraseFromFile` meets its specification.

Evidence that you need to provide

Include in your Electronic Answer Document:

4	7	PROGRAM SOURCE CODE showing the procedure/function `SelectPhraseFromFile`

(7 marks)

Change your code so that when menu choice 4 is selected:
Your program calls procedures/functions:

- `CountPhrasesFromFile`
- `GenerateRandomPhraseNumber`
- `SelectPhraseFromFile`

Then

- assigns the selected phrase to variable `NewPhrase`
- displays the output:

```
Phrase selected is: HIP HOP MUSIC
```

(or some other phrase from the file)

No attempt should be made to ask the user to guess this phrase once it has been selected.

Test that procedure/function `SelectPhraseFromFile` meets its specification.

Evidence that you need to provide

Include in your Electronic Answer Document:

4	8	SCREEN CAPTURES for **two** test runs of the program each showing: the x^{th} phrase selected. *(2 marks)*

Evidence that you need to provide

Include in your Electronic Answer Document:

4	9	PROGRAM SOURCE CODE showing the declaration of any new variable(s) used in the task above. *(2 marks)*

END OF QUESTIONS

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