



COMPUTER SCIENCE

Senior Secondary

Subject Code: ITC315108

FINAL SAMPLE External Assessment

2008

Time: Three Hours

On the basis of your performance in this examination, the examiners will provide results on each of the following criteria taken from the syllabus statement:

Criterion 1 Design and evaluate algorithmic solutions to a range of problems.

Criterion 2 Demonstrate knowledge of a high level programming language.

Criterion 3 Use appropriate objects in the design of programs.

Criterion 4 Demonstrate knowledge and understanding of computer architecture.

Criterion 5 Design and evaluate networking solutions to small scale networks.

Questions: 15

Pages: 16

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CANDIDATE INSTRUCTIONS

You **MUST** ensure that you have addressed **ALL** of the externally assessed criteria on this examination paper.

This paper contains **five** sections. **Answer each section in a separate answer booklet.**

Each section consists of three questions.

You must attempt **ALL** questions. **Note:** You have a choice in Questions 12 of Section D and Question 15 of Section E.

You should make sure that all five sections are attempted in order to achieve a rating on each criterion.

It is recommended that candidates spend approximately 35 minutes on each section.

To be considered for a 'C' rating on a criterion, you must provide a satisfactory answer to at least the first question of the relevant section.

To be considered for a 'B' rating on a criterion, you must provide a satisfactory answer to at least the first two questions of the relevant section.

To be considered for an 'A' rating on a criterion, you must provide a satisfactory answer to all three questions of the relevant section.

You should show the methods used in deriving answers.

You should take care with the presentation of your answers, which should be complete and to the point. Diagrams should be used where appropriate. Complete sentences should be used in questions involving explanations. You are reminded that writing and spelling will be taken into account in the assessment, as will expressions and phrasing that make it difficult for the examiner to understand what you mean.

All written responses must be in English.

Section A — Criterion 1

Answer **ALL** questions in this section.

Use a separate answer booklet for this section.

Question 1

The following partially completed algorithm has been designed for a dishwasher. The dishwasher has buttons labelled "light wash", "heavy wash", "child lock" and "extra rinse", and also a display to indicate the number of minutes the dishwasher will run. The "light wash" button sets the dishwasher to run for 30 minutes, whilst the "heavy wash" button sets it for 50 minutes. The "child lock" button is designed to prevent children from changing the settings by playing with the other buttons - when the child lock function is active all the other buttons are disabled.

Initially (when the dishwasher is first turned on)

```

set minutes to 0
print the value of minutes on the display
set child_lock to off

```

When the "light wash" button is pressed

```

set minutes to 30
print the value of minutes on the display

```

When the "heavy wash" button is pressed

```

set minutes to 50
print the value of minutes on the display

```

When the "child lock" button is pressed

```

if child_lock is on
    set child_lock to off
else
    set child-lock to on

```

- (a) The algorithm given does not disable the "light wash" and "heavy wash" buttons when the child lock is activated. Show how you would modify the algorithm for the "light wash" button to correctly implement this behaviour.
- (b) When the "extra rinse" button is pressed, it should add 2 minutes on to the current number of minutes. Give the algorithm for this button.

Section A continues over the page.

Section A (continued)**Question 2**

An algorithm is to be designed for a computer display in a carpet store to allow customers to automatically get a quote on the cost of carpeting their house. The length and width of a room must be between 1 and 9 m.

The program will have the following buttons:

- “add room area”: adds the area defined by length by width to total area
- “clear total area”: sets total area to zero
- “display price”: calculates and displays the price – this is equal to the total area by the cost of the carpet of \$250/m². If the total area is above 100 m² a discount of 15% is made.

The program will have the following text fields:

- “room length”: holds the length of the room. The number entered must be in the range 1-9 and if not the “room length” is given the default value of 3.
- “room width”: holds the width of the room. The number entered must be in the range 1-9 and if not the “room width” is given the default value of 3.

Initially

Set length to 3
 Set value in “room length” to length
 Set width to 3
 Set value in “room width” to width
 Set total area to 0

Design the algorithm to carry out the appropriate operations:

- (a) when number is entered into “room length”
- (b) when “add room area” button is pressed;
- (c) when the “display price” button is pressed.

Section A continues opposite.

Section A (continued)**Question 3**

You have been employed to write an algorithm for a snack food vending machine that gives a choice of ten foods. The user enters coins via the coin slot, and then presses the button (numbered 1 to 10) corresponding to the food item which they wish to purchase.

If sufficient money has been entered to pay for that item, the machine dispenses it and also the correct amount of change. If insufficient money has been entered the machine makes an error sound to prompt the user to enter more coins. There is also a button which the user can press if they decide not to complete a purchase, which will return the money inserted.

Design the algorithm to complete this task given the following:

- You may assume that the coin slot can determine the value of the coin being entered, and that an unlimited amount of change is available.
- You do not need to design an algorithm to calculate the denomination of the coins to be returned to the user, just the total value of those coins.
- The *Initially* algorithm is as follows:
 - set amount_entered to zero
 - set food_price as array of 10 food costs
 - set selected_food to 0

Section B – Criterion 5

Answer **ALL** questions in this section.

Use a separate answer booklet for this section.

The questions in this section relate to the program on page 8.

In answering these questions you should show how you obtained your answers. This will help the markers.

Question 4

- (a) Find the value of *rem* and *div* when the following statements are executed with *n* having a value of 127:

```
int div = n / 2;
int rem = n % 2;
```

- (b) How many times will the contents of the following **for** loop statement be repeated?

```
for( int i = 0; i < 8; i++)
{.....}
```

- (c) What is the primitive type of the variable *finished* in the following code? Explain the effect the value of *finished* has on the execution of the **if** statement:

```
if (finished)
    bit=0;
else
    bit=workOutBit(denum);
```

Section B continues opposite.

Section B (continued)**Question 5**

- (a) (i) Explain the effect the **if** statement on lines 47-48 of the program has on the execution of the **if** statement on lines 41-44.
- (ii) Examine the lines 41-48 and replace them with fewer lines of code that would achieve the same outcome. (It can be reduced to a single statement.)
- (b) (i) Explain why the **for** statement on line 51 is not the same as the **for** statement on line 39.
- (ii) Explain the change to line 52 that would allow the **for** statement from line 39 to be used on line 51.

Question 6

- (a) Explain why *denum* cannot be used as the formal parameter in the method *workOutBit* and why *denum* is a global variable.
- (b) Change the program so that lines 51-52 are placed in a separate method and the lines 51-52 are replaced by a single statement involving a call to that method. Set up the method so that no other modifications are required to the program to implement the change.

Section B continues over the page.

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Section B (continued)

```

1  import java.applet.*;
2  import java.awt.*;
3  import java.awt.event.*;
4
5  public class Convert extends Applet implements ActionListener
6  {
7      Label prompt;
8      TextField inDenary, outBinary;
9      int denum;
10
11     public void init()
12     {
13         prompt=new Label("Input denary number ");
14         inDenary = new TextField(4);
15         outBinary = new TextField(8);
16         inDenary.addActionListener(this);
17         add(prompt);
18         add(inDenary);
19         add(outBinary);
20     }
21
22     public int workOutBit(int n)
23     {
24         int div = n / 2;
25         int rem = n % 2;
26         denum = div;
27         return rem;
28     }
29
30     public void actionPerformed(ActionEvent e)
31     {
32         int        denary , bit;
33         int[ ]      binaryNumber = new int[8];
34         String      binaryString = "";
35         boolean     finished = false;
36         denary = Integer.parseInt(inDenary.getText());
37         denum = denary;
38
39         for(int i = 0; i < 8; i++)
40         {
41             if (finished)
42                 bit = 0;
43             else
44                 bit = workOutBit(denum);
45             binaryNumber[i] = bit ;
46
47             if(denum == 0)
48                 finished = true;
49         }
50
51         for(int i = 7; i >= 0; i--)
52             binaryString = binaryString + Integer.toString(binaryNumber[i]);
53         outBinary.setText(binaryString);
54     }
55 }

```

Section C – Criterion 3

Answer **ALL** questions in this section.

The questions 8 and 9 in this section relate to the class definition on page 11.

Use a separate answer booklet for this section.

Question 7

A Java applet is being designed for a hand-held device with a touch screen used to score in a table tennis match. The device needs to display the current score for both players as well as displaying the number of games won by each player so far. The user needs to be able to increase/decrease each of the displayed values by one. In addition the user needs to be able to reset the scores and/or the number of games to zero.

- (a) Sketch the appearance of the graphical user interface (GUI) which you would design for this applet. Use only buttons and textfields in your design.
- (b) Briefly describe each of the GUI components you have used in part (a), outlining their role.

Question 8

The Java code on page 10 defines a class used to create a table tennis scorer. The object stores the two scores of players and the number of games each player has won so far. With reference to this definition complete the following in sequence:

- (a) write code that will declare and create an object of type *Scorer*
- (b) using this object change the scores stored in the object so that one player has the score of 3 and the other has a score of 2.
- (c) write code that will use the Scorer object to set the scores back to zero (the end of a game has been reached) and changes the number of games so that one player has won one game and the other player has won no games.

Question 9

The **Scorer** object does not take into account the scoring system for table tennis. Make changes so that normally the score cannot be increased if either score is 11. The exception to this is if both scores reach 10 after this the scores can continue to increase as long as the difference between the scores is less than 2. Give the changes to the method and detail any other changes to the class that are required.

Section C continues opposite.

Section C (continued)

```
public class Scorer
{
    private int[] playerScore = new int[2];
    private int[] playerGame = new int[2];

    public Scorer()
    {
        playerScore[0] = 0;
        playerScore[1] = 0;
        playerGame[0] = 0;
        playerGame[1] = 0;
    }

    public void scoreUp(int player)
    {
        playerScore[player] = playerScore[player] + 1;
    }
    public void scoreDown(int player)
    {
        playerScore[player] = playerScore[player] - 1;
    }

    public void gameUp(int player)
    {
        playerGame[player] = playerGame[player] + 1;
    }
    public void gameDown(int player)
    {
        playerGame[player] = playerGame[player] - 1;
    }

    public void resetScore()
    {
        playerScore[0] = 0;
        playerScore[1] = 0;
    }
    public void resetGame()
    {
        playerGame[0] = 0;
        playerGame[1] = 0;
    }
    public void getScores(int[] score)
    {
        score[0] = playerScore[0];
        score[1] = playerScore[1];
    }
    public void getGames(int[] game)
    {
        game[0] = playerGame[0];
        game[1] = playerGame[1];
    }
}
```

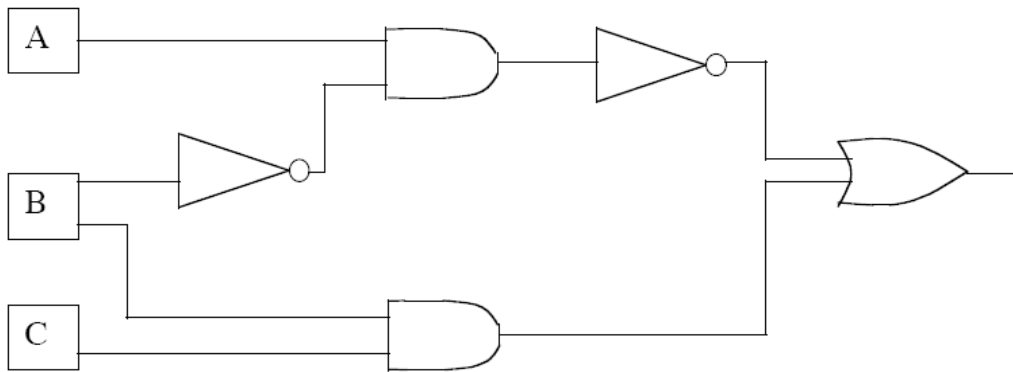
Section D – Criterion 4

Answer **ALL** questions in this section.

Use a separate answer booklet for this section.

Question 10

- (a) Draw the truth table which would result from the following combinational circuit:



- (b) Show how -42 is stored in a 12 bit word using twos complement representation.
- (c) If a character code uses 6 bits how many different characters could be represented by this code.

Question 11

- (a) Show how the following section of Java code can be represented in machine code. Ensure that you document your solution.

```

if (A > 4)
    A = A + B;
else
    A = A - B;
  
```

- (b) Where 'A' is 1, 'B' is 2, 'C' is 3, and so on, what is the following message when each unsigned 5-bit binary number is converted to decimal and then translated into their letter-equivalents:

00101 11000 00001 01101 00110 10101 01110

Section D continues opposite.

Section D (continued)**Question 12**

Answer EITHER Part (a) OR Part (b) of this question, but not both. As a guide your answer to this question should be no longer than half a page.

- (a) Images can be stored digitally using the 24-bit standard, *i.e.* the red, green, and blue components of each pixel is translated to a figure between 0 and 255 and these three figures side-by-side to form a single number.
- (i) Using this representation explain how many colours are available for each pixel. Also give the file size of an image that is 340 by 240 pixels.
 - (ii) JPEG uses a compression technique to reduce the size of the file by reducing the number of colours available. For example a table is used to hold a maximum of 256 colours using the 24-bit standard above. The pixel colour is then given by the position of the colour on the table. Explain the change this would make to the size of the file used to hold the 340 by 240 pixel image.

OR

- (b) A processor has a 16 bit instruction register which uses an instruction format with a 5 bit operation code and an 11 bit operand. The instruction set requires that the operand provide the address used to fetch the contents of a location in the memory.
- (i) Giving reasons indicate the maximum possible size of the memory associated with this processor.
 - (ii) Explain the change in this calculation if the operand was 13 bits. Describe in more general terms the factors that need to be considered when deciding on the format of the instruction. Would a 13 bit operand give you a functional process? Give reasons for your answer.

Section E – Criterion 5

Answer **ALL** questions in this section.

Use a separate answer booklet for this section.

Question 13

- (a) Name two media that can be used to transfer data in a home network, giving an advantage of each media.
- (b) Indicate the extra facilities of an ADSL modem/router compare to a voice band modem.
- (c) When using an Internet Service Provider it is important to ensure a DNS is available. What is the role of the DNS? Would it be possible to operate without a DNS?

Question 14

- (a) Two protocols available for use via the internet are HTTP and TELNET. HTTP is a very useful protocol but it can be dangerous to allow TELNET access to your home LAN.

Explain what a firewall is and how it can prevent TELNET access to a home LAN.

- (b) A home LAN can include a computer set up as a server. What advantages are there is setting up a server on a home LAN?

Question 15

Answer EITHER Part (a) OR Part (b) of this question, but not both. As a guide your answer to this question should be no longer than half a page.

- (a) Paul is a uni student who is still living at home. His house has two stories and the floor between the levels of the house is a thick concrete slab on steel decking. The ADSL modem/router is on the bottom level where the phone line enters the building and is situated in the room where Paul and his two brothers each have desktop computers set up. Paul's parents have an office upstairs and have a laptop each. Sometimes his parents prefer to take their laptop into the lounge(on the top floor). There is a three-in-one printer/scanner/fax which is located in the upstairs office for use by every one in the house.

Give Paul advice, with reasons, on how to best set up a LAN in his home.

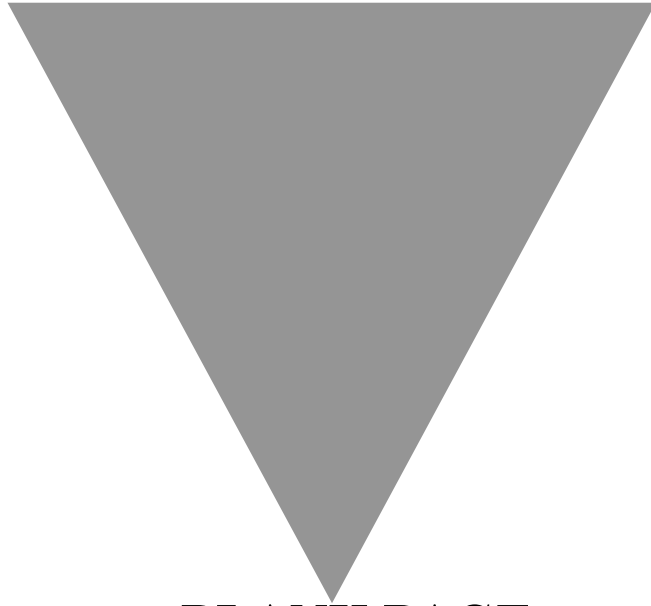
Section E continues opposite.

Section DE (continued)

Question 15 (continued)

OR

- (b) Jane wishes to set up a Web Server on her home network and have it accessible from the internet. Describe the facilities necessary to do this and what protection she should considered against external hacking.



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