Year 11 Computer Science Programming Theory Test - Sample Questions

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer Booklet

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction tape/fluid, eraser, ruler, highlighters

Special items: non-programmable calculators approved for use in this examination, Mathomat and/or Mathaid and/or any system flowchart template

Question 1   (9 marks)

Vikki would like a program to help her work out how many drinks she can buy from the school canteen. Drinks cost $2 each.

```
MODULE Main
        INPUT(amount)
        IF amount >= 2 THEN
                OUTPUT("You can afford 1 drink")
        ELSE IF amount >= 4 THEN
                OUTPUT("You can afford at least 2 drinks")
        ELSE
                OUTPT("You can't afford any drinks")
END Main
```

(a) Identify two errors in the above algorithm. For each error, identify the type of error and explain why it is an error.   (6 marks)

Error 1:_____

Type: _____

Explanation: _____

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Error 2:_____

Type: _____

Explanation: _____

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(b) To be able to test her algorithm, Vikki would like to develop a test plan. Identify values that Vikki should use to test her algorithm and explain why she should use those values.   (3 marks)

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Use the following information to answer Questions 2 and 3

Ellyse has recently installed some new machinery in her warehouse and needs to check the heat that is being produced to ensure a safe working environment. She has set up a system to read the temperature each hour and store that temperature in an array.

Before anyone is allowed to enter the warehouse to work, Ellyse is required to check that the first ten (10) readings are within acceptable limits. The temperature gauge reads data in Celsius and the initial readings are:

temperatures ← [40.5, 45, 34, 43, 48, 51.3, 37, 38, 46.7, 49]

Question 2   (3 marks)

(a) Explain why an array is the most suitable data structure to store the temperature data. (2 marks)

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(b) Identify the type of data that will be stored in the *temperatures* array.   (1 mark)

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Question 3   (7 marks)

Write the function *AverageTemperature* which will take in the temperatures array as a parameter and returns the average temperature after the initial 10 readings.

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Use the following information to answer Questions 4 and 5
Jake runs a business that allows customers to hire garden equipment such as lawn mowers and hedge trimmers. He wants to develop an application to simplify the process of calculating the cost of hiring different machines and process the customer payments. Jake has written the pseudocode below.

```
1       MODULE Main
2              hourlyCost ← 0
3              machine ← ""
4              hours ← 0
5              cost ← 0

6              OUTPUT("What type of machine are you hiring?")
7              INPUT(machine)
8              CALL FindMachineCost(machine, hourlyCost)

9              REPEAT
10                    OUTPUT("How many hours do you need the machine?")
11                    INPUT(hours)
12             UNTIL hours > 0 and hours <= 10

13             cost ← CostOfHire(hours, hourlyCost)
14             OUTPUT("The machine will cost " + cost + " to hire.")
15             OUTPUT("Would you like to proceed? (Y/N)")
16             INPUT(proceed)

17             IF proceed = 'Y' THEN
18                    CALL ProcessPayment(cost)
19             ELSE
20                    OUTPUT("Thank you for your enquiry.")
21             END IF
22      END Main

23      FUNCTION CostOfHire(hours, hourlyCost)
24             CostOfHire ← hours * hourlyCost
25      END CostOfHire

26      MODULE FindMachineCost(machine, hourlyCost)
27             hourlyCost ← 0
28             CASE machine OF
29                    'lawnmower'   :      hourlyCost ← 5
30                    'hedge trimmer' :    hourlyCost ← 4
31                    'whipper snipper' :  hourlyCost ← 6
32                    'leaf blower' :      hourlyCost ← 2
33             END CASE
34      END FindMachineCost

35      MODULE ProcessPayment(cost)
36             OUTPUT('Your payment has been processed successfully')
37      END ProcessPayment
```

Question 4   (3 marks)

Discuss how the use of modularisation will benefit Jake when designing his application.

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Question 5   (5 marks)

(a) Identify the type of control structure that is being used on line 9 of the pseudocode above.

(1 mark)

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(b) Explain the purpose of this section of the program.   (2 marks)

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(c) Discuss why the control structure you have identified is the most appropriate control structure for this section of the program.   (2 marks)

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Question 6   **(9 marks)**

Vikki wants to raise some money for the local primary school. To do this, she is running a silent auction. In this type of auction, each person enters a bid, and the person with the highest bid at the end gets to take home to the prize.

As she is busy, she wants a program that will help her determine the winner of the auction.

Using pseudocode, write a module *SilentAuction* that will:
- Ask the user to enter the name of the person making a bid until no name is entered
- Once a name is entered, ask for the amount of their bid
- Record the name of the person with the highest bid. If two people have the same bid, the first person with that bid is the winner
- Print the winner of the auction

For example, the program should work something like the following:

Name: Peter
Bid: 150
Name: Max
Bid: 100
Name: Jane
Bid: 155
Name:
The winner is Jane

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Question 7   **(5 marks)**

Margaret is employed as a software developer at Google where she works on the team that maintains Gmail. In her spare time, often during her lunch break at work, she works on her own private projects, such as developing an online photo storage tool. She has written most of the code herself and is planning on selling her new tool in time for Christmas. There are several sections of the code that she had problems with, however, and she used her position as a developer to have a look at the code base of Google Photos to get some ideas (although she was careful not to directly copy the code).

Discuss the legal and ethical issues associated with Margaret's photos storage tool.

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Question 8   (4 marks)

Jake is learning to play darts but has trouble working out his score after each turn.

The maximum score that can be achieved with three darts (one turn) is 180, and he wants to know:
- His score for this turn
- How far <u>short</u> of the maximum score he is

Using pseudocode, write a module that will:
- Ask the user to enter the three numbers – the score for each dart (this will be a number between 0 and 60)
- Calculate Jake's total score for this turn
- Print out the total score
- Calculate how far short of the maximum score he is
- Print out how far short of the maximum score he is

For example, the program should work something like the following:

Dart 1: 30 **Dart 2:** 18 **Dart 3:** 4 **You scored 52 this round.** **That is 128 below the maximum.**

MODULE Main

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END Main

Question 9   (4 marks)

James has found some software online that is designed to allow him to remotely connect to another device to share files between devices. This software is aimed at people working from home who would like to share files with their colleagues. The developer provides a link to download the software, but clearly states on his website that the user should pay a fee before downloading and using the software.

(a) Describe one legal issue that James should consider when using this software. (2 marks)

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(b) Describe one ethical issue that James should consider when using this software. (2 marks)

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Question 10   (5 marks)

Consider the pseudocode below.

```
MODULE Main
      numbers ← [5, 7, 3, 4]
      FOR i ← 0 TO 3 DO
            IF i MOD 2 = 0 THEN
                  numbers[i] ← numbers[i] + numbers[i + 1]
            ELSE
                  numbers[i] ← numbers[i] + numbers[i – 1]
            END IF
      END FOR
END Main
```

NOTE: the operator MOD returns the remainder when the first number is divided by the second number. For example, 6 MOD 3 will return 0, while 5 MOD 4 will return 1

i	i MOD 2	i MOD 2 = 0	Numbers			
			0	1	2	3
			5	7	3	4

Question 11   (8 marks)

Consider the following program used to calculate housing loans.

```
MODULE Main
      StampDuty ← 0
      INPUT(HousePrice)
      CALL CalcStampDuty(HousePrice, StampDuty)
      TotalHousePrice ← HousePrice + StampDuty + CalcSettlementFee(HousePrice)
      CALL CalcLoanAmount(TotalHousePrice)
      OUTPUT(LoanAmount)
END MODULE

MODULE CalcStampDuty(HousePrice, StampDuty)
      StampDuty ← 0.1*HousePrice
END MODULE
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```
FUNCTION CalcSettlementFee(HousePrice)
      RETURN HousePrice * 0.05
END FUNCTION

MODULE CalcLoanAmount(TotalHousePrice)
      INPUT(Deposit)
      LoanAmount ← TotalHousePrice – Deposit
END MODULE
```

(a) Identify the **two (2)** local variables in this program outside of the Main module.   (2 marks)

Variable 1 _____

Variable 2_____

(b) State **two (2)** reasons why it is often not considered a good idea to use global variables.

(2 marks)

Reason 1 _____

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Reason 2 _____

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(c) An error occurs when the program tries to output LoanAmount. Explain the reason this is
    occurring and suggest one way the error could be corrected.   (4 marks)

Explanation _____

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Suggestion _____

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Question 12   (7 marks)

Consider the following program.

```
BEGIN
        INPUT(Num1)
        INPUT(Num2)
        WHILE Num1 != Num2 DO
                IF Num1 > Num2 THEN
                        Num1 ← Num1 - Num2
                ELSE
                        Num2 ← Num2 - Num1
                END IF
        END WHILE
        OUTPUT(Num1,Num2)
END
```

(a) Complete the trace table for the program below using the following pair of inputs as test data.

(5 marks)

Num1 ← 15, Num2 ← 41

Num1	Num2	Num1 != Num2	Num1 > Num2	Output

(b) Identify and describe the type of error that trace tables are used to detect.   (2 marks)

Error Type _____

Description _____

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Question 13   **(3 marks)**
(a) Explain the term 'modularisation' as it applies to programming.   (1 mark)

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(b) Describe two advantages of using modularisation in a program.   (2 marks)

Advantage 1_____

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Advantage 2_____

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Use the following information to answer question 14.

Airlines are required to display a video to passengers informing them of the various risks and protocols associated with travelling during the pandemic. Big Red Roo Airlines have responded by producing a series of videos tailored to different age groups.

The module DisplaySafetyVideo selects and displays a video based on the string value returned from the BiggestAgeGroup function.

```
MODULE DispaySafteyVideo()
        Video ← default_video
        SelectedAgeGroup ← BiggestAgeGroup()
        CASE SelectedAgeGroup OF
                "elderly":        Video ← high_risk_video
                "adult":          Video ← med_risk_video
                "child":          Video ← low_risk_video
        END CASE
        OUTPUT(Video)
END MODULE
```

Question 14   (7 marks)

Complete the pseudocode for the BiggestAgeGroup function in the space provided below such that it returns a string, either "child", "adult" or "elderly", representing the age group with the largest number of passengers on the flight. Assume that the age groups will never be equal in number.

```
FUNCTION BiggestAgeGroup()
        AgeGroupTotals ← [0, 0, 0]
        FOR i ← 0 TO passengers.Length – 1
                CASE passengers[i].Age OF
                        >= 65: AgeGroupTotals[2] ← AgeGroupTotals[2] + 1
                        >= 18: AgeGroupTotals[1] ← AgeGroupTotals[1] + 1
                        < 18: AgeGroupTotals[0] ← AgeGroupTotals[0] + 1
                END CASE
        END FOR
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END FUNCTION

Question 15   **(4 marks)**

John has never programmed an online game before and doesn't quite know where to start. Luckily, he found some source code for a similar game on a website and plans to use it as a starting point. Briefly discuss one legal and one ethical issue associated with John using this code in his game.

Legal Issue _____

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Ethical Issue _____

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Refer to the following scenario to answer question 16
Violet is doing a project on global warming. She has found data online for the average global temperatures (the average of all temperatures measured around the world on any given day) recorded every day over the past year. Unfortunately, the temperatures are all in Fahrenheit and her project requires them to be in Celsius.

The project description provides the following formula for students to convert temperature readings from Fahrenheit to Celsius, where C is the reading in Celsius and F is the reading in Fahrenheit.

$$C = (F-32) \times 5/9$$

Question 16   (21 marks)

Violet is trying to write a program that will:

- Read the daily Fahrenheit temperature readings from a file into an array.

- Convert all the Fahrenheit temperatures into Celsius and store the converted values in a new array.

- Output the average, maximum and minimum temperature values

So far, she has written the following pseudocode for the main module:

```
MODULE Main
        Fahrenheit ← FileToArray(datafile)
        Celsius ← []
        Call ConvertToCelsius(Fahrenheit, Celsius)
        Call CalculateTempStatistics(Celsius)
END Main
```

(c) The procedure ConvertToCelsius converts Fahrenheit temperatures in one array (provided through the first parameter) into corresponding Celsius temperatures in another array (provided through the second parameter). Assume both parameters are reference parameters. Write the pseudocode for the procedure in the space below.

(6 marks)

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(d) The procedure CalculateTempStatistics takes an array of temperatures as a parameter and outputs the average, maximum and minimum of all the temperatures. Write the pseudocode for the procedure in the space below. (15 marks)