OCR
Oxford Cambridge and RSA

AS Level Computer Science

H046/02 Algorithms and problem solving

Tuesday 14 June 2016 – Afternoon

Time allowed: 1 hour 15 minutes

6411605939

Do not use:
- a calculator

H046/02

First name									
Last name									
Centre number						Candidate number				

INSTRUCTIONS
- Use black ink.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION
- The total mark for this paper is **70**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **16** pages.

1 Programming languages consist of three basic programming constructs. For each construct, state its name and give a working example.

Construct 1: .....

Example: .....

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Construct 2: .....

Example: .....

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Construct 3: .....

Example: .....

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[6]

2* A software company is going to write a policy on its use of variables when writing programs. The policy will cover the use of local and global variables and variable naming rules and conventions.

Discuss the content of this policy and why it is required. **[9]**

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3 **(a)** A software development company is planning to produce a bespoke monitoring system for a factory which produces hazardous chemicals. One testing strategy is whitebox testing.

State the name of **three** other testing strategies that the company could use.

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2 .....

3 ..... **[3]**

(b) The company decide to use whitebox testing. Justify why whitebox testing is used in this case.

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..... **[3]**

(c) A temperature control system monitors and regulates temperature by switching a heater on or off. The temperature sensor of the system provides a reading accurate to 3 decimal places (e.g. 87.489). There are two warning lights, amber and red. The system controls the temperature and warning lights as follows:

- The heater is turned off when the sensor reading is 97.500.
- The heater is turned on when the sensor reading is 95.000.
- The red warning light is on when the sensor reading is 98.100 or above.
- The amber warning light is on when the sensor reading is outside the range 95.000 to 97.500 (inclusive), and the red warning light is **not** on.

Complete the boundary test table below.

Sensor value	Output	On/off
94.999	Amber light	on
95.000	Heater	
	Amber light	
97.500	Heater	
	Amber light	
97.501	Amber light	
98.099	Amber light	
	Red light	
98.100	Amber light	
	Red light	

[5]

4 **(a)** Describe the steps involved in a binary search to find the value 47 in the list below.

4, 7, 8, 21, 46, 47, 51

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[4]

(b) A programmer has been tasked with writing a function that uses a binary search to return a Boolean value. The function should return `true` if the target integer is found in a list of integers. Using pseudocode, write an algorithm for the function.

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[8]

(c) The target integer 8 exists in a list of integers 1, 4, 6, 9, 8, 12, 15 but is not found during a binary search. There are no errors in the code.

(i) Give the reason why the target integer 8 is **not** found.

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..... **[1]**

(ii) Identify and describe an alternative search algorithm that could be used.

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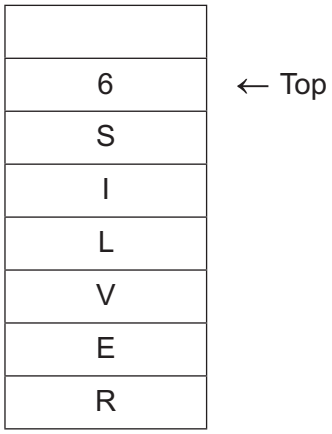
..... **[3]**

(d) A stack, in shared memory, is being used to pass a single variable length ASCII string between two sub-systems. The string is placed in the stack one character at a time in reverse order with the last byte holding the number of characters pushed i.e the text “SILVER” would be held in the stack as:



Use pseudocode to write a procedure that will take a text string passed to it and push it to the stack in the format defined above. You may assume any given input will fit in the stack.

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..... **[6]**

5 A car racing team uses a car simulator to test their drivers in a range of cars on different race tracks.

(a) The car simulator uses an abstraction of the real car and race track. Identify **two** ways in which the simulator could use abstraction.

1 .....

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2 .....

..... **[2]**

(b) Identify **three** inputs that will be required to configure the initial conditions for running the simulation.

1 .....

2 .....

3 ..... **[3]**

6 **(a)** A programmer is going to design a procedure that will prompt for and receive two values, A and B. The procedure will then compare them. The procedure will also write a suitable message to a file on disk depending on whether:

- the values are the same
- A is less than B, or
- B is less than A.

Use pseudocode to write the procedure.

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..... **[5]**

(b) The code below uses a procedure:

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name = "Sam"
addMessage(name)
print(name)

procedure addMessage(inText:byVal)
     inText = "Hello " + inText
endprocedure
```

Explain why this program outputs `Sam` rather than `Hello Sam`.

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..... **[2]**

(c) Explain the advantages of writing an application using a modular approach.

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7 Given the following pseudocode:

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d = 5

if ((a > b) OR (b >= c)) then
   if ((c < a ) XOR (c < b)) then // Check to see if one or the other
                                  // comparisons are TRUE, but not both
      d = 15
   else
      d = 16
   endif
else
   d = 14
endif

print(d)
```

(a) State the value of `d` if `a=42`, `b=41` and `c=42` .....

(b) State the value of `d` if `a=42`, `b=36` and `c=4` .....

(c) State the value of `d` if `a=42`, `b=36` and `c=36` .....

(d) Give **one** potential value of `b` if the output value of `a=42`, `c=44` and `d=14`. .....

[4]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

PLEASE DO NOT WRITE ON THIS PAGE