MSc IT Primer course test

Monday, 22nd September 2014
Duration: 60 mins (75 mins allowed)

• Attempt ALL 10 questions on the paper.
• There are a varying number of marks for each question.
• Simplicity and clarity of expression in your answers is important.
• You are allowed to use electronic calculators and other such devices.
• If you have any code that you write on a computer then please print it out and attach it to this paper.

Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page.

Name: (In BLOCK CAPITALS) ____________________________________________

Contact Email: _______________________________________________________

College ID: __________________________________________________________________

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<th>Question:</th>
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<td>Marks:</td>
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A — Programming

Question 1 .................................................. Total: 12 marks
Write a simple algorithm in Python to compute the sum of a list of numbers by adding the even position numbers and subtracting the odd position numbers.

- The input to the algorithm is a list of numbers, L.

- The output is the sum of these numbers found by adding the even position numbers and subtracting the odd position numbers.

- The list is numbered from position 0.

- For example, for the input L = [3, 4, 5, 10] the output should be 6, i.e., -3 + 4 - 5 + 10.

- If L is empty, the output should be 0.

Question 2 .................................................. Total: 8 marks
Write an algorithm in Python to find the nth value of the Fibonacci sequence.

Question 3 .................................................. Total: 8 marks
Write a program in Python that takes the values from the user until the value 99 is entered. Then process the values resulting in the product of every other one of the numbers entered.
B — FoC

Question 4 ................................................................. Total: 12 marks
Provide the truth tables for the following expressions:
Where
\( \text{AND} = \land \)
\( \text{OR} = \lor \)
\( \text{NOT} = \neg \)
(a) \( \neg A \land B \)
(b) \( \neg A \lor \neg B \land C \)
(c) \( P \rightarrow Q \lor Q \rightarrow P \)
(d) \( P \rightarrow Q \land \neg P \lor Q \)
(e) \( (P \rightarrow Q) \iff \neg(P \lor Q) \)

Question 5 ................................................................. Total: 9 marks
The numbers \( x \) and \( y \) satisfy the following inequalities:
\[
2x + 3y \leq 23 \\
x + 2 \leq 3y \\
3y + 1 \leq 4x
\]
Which of the following is the largest possible value of \( x \)?
(a) 6
(b) 7
(c) 8
(d) 0.9

Question 6 ................................................................. Total: 14 marks
(a) Briefly explain the difference between binary, octal, and hexadecimal.  
   You should provide appropriate examples to illustrate your answer.  
   6 marks
(b) Convert the following:
   i. \( 20414_5 = (\cdots)_{10} \)
   ii. \( 6319_{10} = (\cdots)_8 \)
   iii. \( 110111001_2 = (\cdots)_8 \)
   iv. \( C3A_{16} = (\cdots)_8 \)
   8 marks
Question 7 ................................. Total: 12 marks
Using the “box and arrow” representation we discussed in class provide memory diagrams for the following:
(a) [3, [4, [5, 6, [1, 2]], 5, [4, 5, []], [12, 6]]]
(b) [[73, 3], 4, [5, 62, 9], [5, [4, 5]], 12]
(c) []

Question 8 ................................. Total: 12 marks
Alice, Bob and Charlie are well-known expert logicians; they always tell the truth. They are sat in a row. In each of the scenarios below, their father puts a red or blue hat on each of their heads. Alice can see Bobs and Charlies hats, but not her own; Bob can see only Charlies hat; Charlie can see none of the hats. All three of them are aware of this arrangement.
(a) Their father puts a hat on each of their heads and says: Each of your hats is either red or blue. At least one of you has a red hat. Alice then says “I know the colour of my hat”. What colour is each persons hat? Explain your answer.
(b) Their father puts a new hat on each of their heads and again says: “Each of your hats is either red or blue. At least one of you has a red hat”. Alice then says “I dont know the colour of my hat”. Bob then says “I dont know the colour of my hat”. What colour is Charlies hat? Explain your answer.
(c) Their father puts a new hat on each of their heads and says: “Each of your hats is either red or blue. At least one of you has a red hat, and at least one of you has a blue hat”. Alice says “I know the colour of my hat”. Bob then says “Mine is red”. What colour is each persons hat? Explain your answer.
C — Computer Systems

Question 9 ................................................................. Total: 4 marks
What is the difference between a compiler and an interpreter? Provide an example to illustrate your answer.

Question 10 ................................................................. Total: 9 marks
(a) What is the role of the CPU?
(b) What is the role of the Operating System?
(c) What do you understand by Client/Server architecture?
You should provide appropriate examples to illustrate your answer.