

UNIVERSITY EXAMINATION 2019/2020
YEAR III SEMESTER I EXAMINATION FOR DEGREE OF BACHELOR OF BUSINESS
INFORMATION TECHNOLOGY AND BACHELOR OF SCIENCE IN COMPUTER
SCIENCE

ICS 2301& SCS 2302- Design and Analysis of Algorithms Year III Semester I 2019

Date: Thursday, 19th December 2019

Time: 8.30am – 10.30am

INSTRUCTIONS: Answer Question One and Any Other Two questions

QUESTION ONE(20 MARKS)

- a) Describe the term algorithm [1 mark]
- b) Explain any two reasons why algorithm design is important [4 marks]
- c) Explain any three methods used to solve a recurrence relation [6 marks]
- d) Explain any three problems that can be solved by data structures [6 Marks]
- e) Write down a recipe for cooking your favorite dish - *Ugali* with the precision required by an algorithm. [5 marks]
- f) Distinguish the following terms as used in analysis of algorithms; [6 Marks]
 - i. Worst Case
 - ii. Average Case.
 - iii. Best Case
- h) Suppose X is an algorithm and n is the size of input data, the time and space used by the Algorithm X are the two main factors which decide the efficiency of X. Explain the complexity of an algorithm $f(n)$. [2 marks]

QUESTION TWO (20 MARKS)

- a) Discuss the selection sort algorithm in the following sub-headings
 - i. Concept [2 Marks]
 - ii. Algorithm [5 Marks]
 - iii. Complexity magnitude [3 Marks]
- b) Demonstrate the selection sort results for each pass for the following initial array of elements
21, 6, 3, 57, 13, 9, 14, 18, 2 [10 Marks]
[@2marks for any valid pass]

QUESTION THREE (20 MARKS)

- a) Explain any sorting technique which follows divide and conquer mechanism with an example. [5 Marks]
- b) Discuss binary search algorithm [10Marks]
- c) The Fibonacci function can be defined by the recurrence relation

$$\text{Fib}(n) = \begin{cases} 1 & n=1 \\ 1 & n=2 \\ \text{fib}(n-1) + \text{fib}(n-2) & n>2 \end{cases}$$

Compute the first 6 sequence of the function. (Show workings) [5 Marks]

QUESTION FOUR (20 MARKS)

- a) Describe the algorithm design and analysis process (6 marks)
- b) i. Explain 'in order' and post order' tree traversal techniques (4marks)
 - ii. Differentiate between optimal and feasible solution (4marks)
 - iii. What is a flow chart? How different is it from an algorithm (4 marks)
- c) Describe the term tautology in logic (2 marks)

QUESTION FIVE (20 MARKS)

- a) Solve this problem for the peasant by writing an algorithm for a solution (8 marks)

A peasant finds himself on a river bank with a wolf, a goat, and a head of cabbage. He needs to transport all three to the other side of the river in his boat. However, the boat has room for only the peasant himself and one to her item (either the wolf, the goat, or the cabbage). In his absence, the wolf would eat the goat, and the goat would eat the cabbage.
- b) Write short notes on the following order of growth metrics (6 Marks)
 - i. Big O notation
 - ii. Big Omega notation
 - iii. Theta notation
- c) Compare quick sort and bubble sort algorithms on their performance (6 Marks)