TECHNICAL UNIVERSITY OF MOMBASA

Institute of Computing & Informatics

UNIVERSITY EXAMINATION FOR

BACHELORS OF SCIENCE IN INFORMATION TECHNOLOGY
BSIT/SEP2015/J-FT Y3S1

ICS 2301 DESIGN & ANALYSIS OF ALGORITHMS
SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: SEPTEMBER 2018

TIME: 2 HOURS

<u>**Instructions to Candidates**</u>
You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of Five questions. Attempt Question One and any two other
Do not write on the question paper.

Question ONE

<u>**QUESTION ONE**</u>

   a)   Give any four considerations for the choice of an algorithm.   [4marks]

   b)   Define asymptotic notations, hence distinguish between asymptotic notation and

        conditional asymptotic notation.   [6marks]

   c)   Describe the design paradigm "Dynamical Programming", which problem does it

        address and in which situations can it be used?   [6marks]

   d)   State any three reasons why algorithms can be considered as a technology   [3 marks]

   e)   What is the formula for the variable *count* in terms of *n* after the following algorithm-

        fragment is executed?   [5 marks]

            (1) count = 0;

            (2) For $i = 1$ through n do

            (3)   For $p = 1$ through 3 do

            (5)   For $k = 1$ through i do

            (4)   count = count +1;

                end for loops;

f) Consider the following statements in the pseudo code below, what list of elements would be in the array B. [4marks]

Declare B[6] as integers

Index = 0

DOWHILE Index < 6

B[index] = index*2

Index = index + 1

ENDDO

g) Differentiate between apriori and aposteriori analysis of an algorithm [2marks]

QUESTION TWO

a) i) Define space and time complexities of an algorithm. [4marks]

ii) Bring out the necessity of time and space complexity analysis with suitable examples

[6marks]

b) i)Write the algorithm for bubble sort [6marks]

ii) Apply the algorithm in question b) i) above to sort the list of elements **5, 1,** 4, 2, 8 in

ascending order [4 Marks]

QUESTION THREE

a) Define the following terms [6 marks]

i. Algorithm

ii. An instance of a problem

iii. loop invariant

b) Explain the various Asymptotic notations used in algorithm design? [6marks]

c) Explain the time complexity of the following algorithm-fragment in terms of n.

[4marks]

.(1) For i =1 through n do

.(2) For $j = i$ through $i+3$ do

.(3) -constant number of steps-

end for loops;

d) Explain any two areas in computing where algorithms can be used. [2marks]

e)   Below is a Pseudo code algorithm that illustrates the calculation of the mean (average) of a set of n numbers, Calculate the computing time for this algorithm in terms of input size n. [2marks]

1. n = read input from user

2. Sum = 0

3. i = 0

4. While i < n

5. Number = read input from user

6. Sum = sum + number

7. i = i + 1

8. Mean = sum / n

QUESTION FOUR

a) Differentiate between Deterministic and Non Deterministic algorithms.   [4mark]

b) i) Write an algorithm to merge sort using divide and conquer strategy   [6marks]
   ii)Trace the algorithm in question b, i) above for the input set{4,7,1,3,8,5}.[4 Marks]

c) Describe the steps in design and analysis of algorithms   [6marks]

QUESTION FIVE

a) Compute the big-Oh running time of the following code segment: [2marks]

```
for (i = 2; i < n; i++) {
sum += i;
}
```

b) State any two factors that influence the running time of an algorithm   [2marks]

c) i)Write an algorithm for the selection sort.   [6marks]

   ii) Calculate the computing time for this algorithm in terms of input size n, [4marks]

d) Write the algorithm for insertion sort and analyze its time complexity for the best and the worst case.   [6marks