TECHNICAL UNIVERISTY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY

UNIVERSITY EXAMINATION FOR BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY
(BSIT M11/M12/EV/FT)

ICS 2301: DESIGN & ANALYSIS OF ALGORITHMS

END OF SEMESTER EXAMINATION
SERIES: APRIL 2013
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*

This paper consists of **FIVE** questions. Attempt question **ONE** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One (Compulsory)

a) Define the following terms: **(6 marks)**
- **(i)** Algorithm
- **(ii)** An instance of a problem
- **(iii)** Loop invariant

b) State any **FOUR** characteristics of a good algorithm. **(4 marks)**

c) Discuss the algorithm design and analysis process with suitable example in each step. **(8 marks)**

d) Explain the concept of symptotic notations indicating the commonly used notations and their significance. **(6 marks)**

e) What is an optimization problem? **(2 marks)**

f) What is the formula for the variable count in terms of n after the following algorithm – fragment in executed? **(4 marks)**

(i) Count = 0;
(ii) For i = 1 through n do
(iii) For P = 1 through 3 do
(iv) For K = 1 through i do
(v) Count = count + I;
End for loops;

Question Two

a) State the three loop invariance property that prove the algorithm is correct. **(6 marks)**

b) Consider the following insertion sort algorithm.

1 For i 2 to length [A]
2 Key ← A [i]
3 // Insert A [i] into the sorted sequence A[1..2-1]
4 j i – i
5 while j >0 and A [j] > key
6 A [j + 1] A[j]
7 j - 1 ←
8 A [j + 1] key
←

(i) State a loop invariant for the outer for loop. **(1 mark)**
(ii) State a loop invariant for the inner for loop **(1 mark)**
(iii) State the best case and worst case analysis for an insertion sort algorithm. **(6 marks)**

c) Write bubble sort algorithm and apply it to sort the list E, X, A, M, P, L, E **(6 marks)**

Question Three

a) State any **THREE** factors that influence the running time of an algorithm. **(3 marks)**

b) Compute the big –Oh running time of the following code segment. **(3 marks)**

```
For (i = 2; i<n; i ++) {
    Sum + = i;
    }
```

c) Give an algorithm for quick sort and trace the algorithm with an example. Analyze its time complexity. **(8 marks)**

d) (i) Define recursion. **(2 marks)**

(ii) Compare recursion algorithm with iterative functions; use a high level language piece of code or pseudo code to demonstrate the difference. **(4 marks)**

Question Four

a) Examine the following piece of code; associate a "cost" with each statement and find the "total cost" by calculating the total number of times each statement is executed. **(4 marks)**

Inst	code
i)	For (int i = 0; i<n; i ++)
ii)	For int j = 0; j< n; j++)
iii)	{count << i;
iv)	P = p + i:
	}

b) Explain any **TWO** practical applications of problem solved by algorithms **(2 marks)**

c) Differentiate between Deterministic and Non Deterministic algorithms. **(2 marks)**

d) Describe the divide and conquer approach to solve a programming problem. **(6 marks)**

e) Discuss the following algorithm design techniques.
(i) Dynamic programming **(2 marks)**
(ii) Back tracking **(2 marks)**

f) How would you specify a computational problem? **(2 marks)**

Question Five

a) Give an algorithm for merge sort and trace the operation for the following sequence. 6, 2, 4, 6, 1, 3, 2, 6. Brief on its complexity. **(8 marks)**

b) Briefly explain how big oh notation models asymptotic growth rate. **(4 marks)**

c) Discuss the greedy method. **(4 marks)**

d) What is a Brute force method? When does a brute force method becomes applicable. **(4 marks)**