TECHNICAL UNIVERISTY OF MOMBASA

Faculty of Engineering & Technology

UNIVERSITY EXAMINATION FOR:
BACHELOR OFSCIENCE IN INFORMATION TECHNOLOGY
(BSIT 12J – Y3 S1)

ICS 2301: DESIGN & ANALYSIS OF ALGORITHM

END OF SEMESTER EXAMINATION
SERIES: APRIL 2014
TIME: 2 HOURS

Question One (Compulsory)

a) Give any FOUR considerations for the choice of an algorithm. **(4 marks)**

b) Write an algorithm for insertion sort and analyse its time complexity for the best and worst case.
(10 marks)

c) (i) Define a loop invariant. **(2 marks)**
    (ii) Describe the loop in variant property for the insertion sort algorithm derived in question one (b) above. **(9 marks)**

d) Consider the following statements in the pseudo-code below, what list of elements would be in the Array A, Dryrun to show your answer. **(5 marks)**

```
Declare A[5] as integers
Index = 0
DOWHILE = Index < 5
A [Index] = Index * 2
Index = Index + 1
END DO
```

Question Two

a) Discuss the algorithm design and analysis process with suitable examples in each step.**(6 marks)**

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

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

d) (i) Define recursion. **(2 marks)**
(ii) Compare recursive algorithm with iterative functions, use a high level language piece of code to demonstrate the difference. **(4 marks)**

Question Three

a) Describe the components of algorithm that uses the divide and conquer approach to solve a programming problem. **(6 marks)**

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

c) (i) Derive an algorithm for the mere sort. **(6 marks)**
(ii) Comment on the running time of the algorithm derived in question c(i) above. **(2 marks)**

d) Differentiate between bottom up approach and top down approach in dynamic programming. **(6 marks)**

Question Four

a) Explain the necessity of time and space complexity analysis of algorithm with suitable examples. **(6 marks)**

b) (i) Write an algorithm for bubble sort. **(6 marks)**
(ii) Apply the algorithm in question b(i) above to sort the list E, X, A, M, P, L, E **(4 marks)**

c) Compute the big-oh running time of the following code segment. **(4 marks)**
```
for (i = 2, I <n; i++) {
sum + 2;
}
```

Question Five

a) (i) What do we mean when we say that a sorting algorithm is stable **(2 marks)**
(ii) Is insertion sort stable? **(2 marks)**

b) Describe bucket sort. **(4 marks)**

c) Consider the following sequential search algorithm.
```
Int sequentialsearch (const int a[ ], int item, int n} {
    for (int I = 0; i <n a [i]! = item; Ih);
    If (I = = n)
        Return – 1;
        Comment on the
```
(i) Best case
(ii) Wort case
(iii) Average case analysis for the algorithm

d) State any THREE reasons why algorithms can be considered as a technology. **(3 marks)**