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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2019/2020 ACADEMIC YEAR
SECOND YEAR, FIRST SEMESTER EXAMINATION
BACHELOR OF SCIENCE IN COMPUTER SCIENCE

KCS 204 - DATA STRUCTURES AND ALGORITHMS

Date: 12th April, 2019
Time: 11.00am – 1.00pm

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS

a) Compare the following algorithms giving a brief analysis of their worst and best cases.
   i) Quick sort
   ii) Merge sort
   (8 Marks)

b) Differentiate between the following
   i) Linked list and an array
   ii) Stack and queue
   iii) Worst case-time and best-case time for an algorithm (6 Marks)

c) Explain the following operations of a stack data structure
   i) Peek( ) (2 Marks)
   ii) isFull( ) (2 Marks)
   iii) isEmpty( ) (2Marks)

d) Explain a necessary and sufficient condition for a graph to have a spanning tree (4 Marks)

e) Describe how the following searching strategies work;
   i) Depth First Search (DFS)
   ii) Breath First Search (BFS) (4 Marks)

f) Explain what dynamic programming and divide and conquer problem solving strategies have in common. (2 Marks)

QUESTION TWO (20 MARKS

a) Describe the following two computer graphs representations techniques

i) Adjacency matrix representation

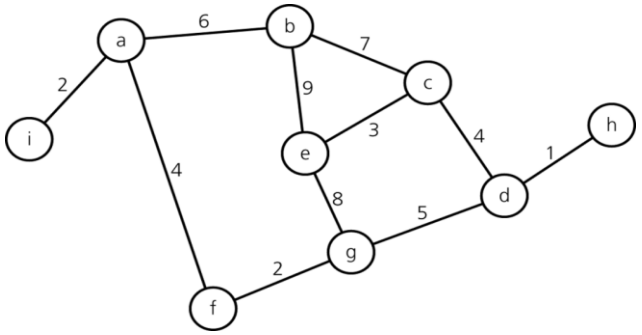
ii) Adjacency list representation (6 Marks)

b) Explain the following graph applications in design and analysis of algorithms

i) Travelling sales man problem

ii) Graph coloring problem (6 Marks)

c) Differentiate between internal sort and external sort as used in the design and analysis of algorithms (4 Marks)



d) Given the above graph, generate a minimum spanning tree using the Kruskal's algorithm (4 Marks)

QUESTION THREE (20 MARKS

a) Trace bubble sort algorithm as it sorts the following array in ascending order.

[5, 1, 3, 6, 4] (5 Marks)

b) Using a pseudo code, describe the algorithm in (a) above (5 Marks)

c) If G is a directed graph, define the following concepts associated with the graph

i) Indegree

ii) Outdegree (4 Marks)

d) Briefly describe how the binary search algorithm works (4 Marks)

e) Before a binary search operates on an array input of size *n*, what needs to be done? (2 Marks)

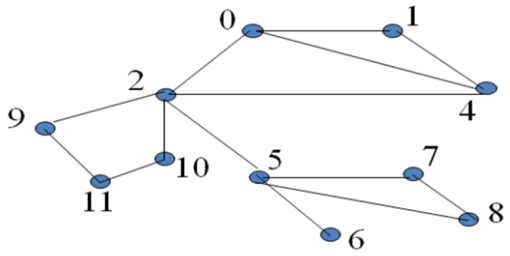
QUESTION FOUR (20 MARKS

a) Trace the quick sort partitioning algorithm as it partitions the following array [65 70 75 80 85 60 55 50 45]; use the first element as the pivot in the first pass, 60 as the pivot in the left sub-block pass and 85 as the pivot in the right sub-block pass. (8 Marks)

b) What is the maximum number of comparison required by a merge sort algorithm to sort an array of size 11? (2 Marks)

c) Show that the complexity of merge sort algorithm is $O(N \log_2 N)$ (4 Marks)

d) Given the following graph, sketch a Depth First Search tree. (6 Marks)



Graph G

QUESTION FIVE (20 MARKS)

a) Describe the term complexity of an algorithm (4 Marks)

b) Distinguish between the time and space complexities of an algorithm. (4 Marks)

c) Describe four stack operations. (6 Marks)

d) Convert the following infix expressions into its equivalent prefix and postfix expressions

A*(B + D) / E - F * (G + H /K) (6 Marks)