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KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION FOR 2024/2025 ACADEMIC YEAR
SECOND YEAR, FIRST SEMESTER EXAMINATION
FOR THE BACHELOR OF SCIENCE IN COMPUTER SCIENCE

KCS 2204 DATA STRUCTURES AND ALGORITHMS

Date: 14TH AUGUST, 2024
Time: 2:30PM - 4:30 PM

INSTRUCTIONS TO CANDIDATES
ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTION

QUESTION ONE: COMPULSORY (30 MARKS)

a) Classify the two main factors that the performance of an algorithm is defined by and is measured with. **(2 Marks)**

b) Given a group of Integers as 40, 25, 37, 55, 28 respectively, write a C codes which demonstrates the declaration and initialization of an array in one statement and separately. **(6 Marks)**

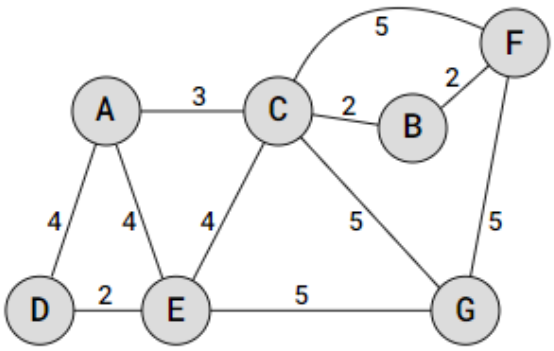
c) Write an algorithm that counts number of nodes in a linked list. **(5 Marks)**

d) Given the Big Oh function

Let f(n) = n2+ n + 5.

Determine the three possibilities from the function. **(3 Marks)**

e) Consider the Graph below with the source vertex as D. Showing your steps using Dijkstra's algorithm, find the shortest path to the last vertex indicating the value and the letter. **(6 Marks)**



f) With the use of illustrations, explain the two basic operations associated with queues as used in data structures **(4 Marks)**

g) Summarize the two different kinds of data structures in computer science. **(4 Marks)**

QUESTION TWO: (20 MARKS)

a) Describe the procedure of deleting a node that is in between the chain illustrating your answer. **(6 Marks)**

b) Consider the following recurrence

$T(n) = 4T(n/2)+n$

Obtain the asymptotic bound using recursion tree method. **(6 Marks)**

c) Using illustrations discuss the two types of deque carefully showing the illustrations. **(8 Marks)**

QUESTION THREE: (20 MARKS)

a) Write a C/C++ program to calculate the average of a set of numbers. **(8 Marks)**

b) Explain three features of recursive program. **(3 Marks)**

c) Using an illustration, discuss the greedy algorithm with an example of how it is used. **(6 Marks)**

d) Here is an array with exactly 15 elements:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Suppose that we are doing a binary search for an element. Indicate any elements that will be found by examining two or fewer numbers from the array. **(3 Marks)**

QUESTION FOUR: (20 MARKS)

a) Suppose an initially empty queue Q has performed a total of 32 enqueue operations, 10 first operations, and 15 dequeue operations, 5 of which returned null to indicate an empty queue. What is the current size of Q? **(6 Marks)**

b) Consider the following expression and evaluate the value of the given expression in a stack.

15, 3, -, 2, *, 6, 6, /, - **(9 Marks)**

c) Using C++, write a program that implements algorithm for inserting data elements into one dimensional array? **(5 Marks)**

QUESTION FIVE: (20 MARKS)

a) Showing your workings, Convert the following expressions to prefix and postfix.

((P + ((Q ^ R) – S)) * (U – (P / R))) **(8 Marks)**

b) With the aid of a diagram and an example, differentiate between Sibling and Height of Tree. **(6 Marks)**

c) One of the duties of a stack is balancing of symbols, create an algorithm to elaborate on how stacks can be used for checking the balancing of symbols. **(6 Marks)**