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KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2024/2025 ACADEMIC YEAR
SECOND YEAR, FIRST SEMESTER EXAMINATION
FOR THE BACHELOR OF BUSINESS AND INFORMATION TECHNOLOGY
KBI 2202 DATA STRUCTURES AND ALGORITHMS

Date: 14TH AUGUST 2024
Time: 2:30PM – 4:30PM

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

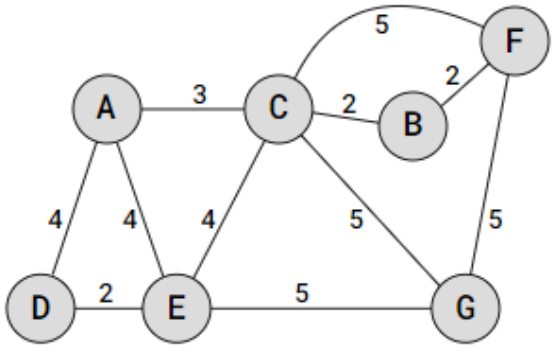
a) Classify the two main factors that the performance of an algorithm is defined by and is measured with. **(2 Marks)**

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: **(3 Marks)**

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.

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. **(8 Marks)**

((P + ((Q ^ R) – S)) * (U – (P / R)))

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)**