KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY

UNIVERSITY EXAMINATIONS

YEAR FOUR EXAMINATIONS FOR THE AWARD OF THE DEGREE OF BACHELOR OF

BUSINESS INFORMATION TECHNOLOGY

KBI 2104: THEORY OF ALGORITHMS

STREAM: YEAR ONE SEMESTER ONE   TIME: 2 HOURS

DAY/DA TE:

INSTRUCTIONS

Answer **QUESTIONS ONE** and any other **TWO** questions.

Write your answers legibly and use your time wisely.

This is a closed book exam. No reference material is allowed in the exam room.

No mobile phone allowed in the exam room (make sure to switch off)

PART A: ANSWER ALL QUESTIONS

QUESTION ONE (30 MARKS)

(a) Give FOUR desirable characteristics of any algorithms.   (4 Marks)

(b) Give THREE areas of algorithms applications.   (3 Marks)

(c) Give the three major steps in a divide-and-conquer algorithm.   (3 Marks)

(d) Discuss the following terms as they relates to algorithms analysis.

    (i) Data size

    (ii) Running time.   (4 Marks)

(e) List the sequence of steps followed in developing a dynamic-programming algorithm.
                                                                             (4 Marks)

(f) What is the order of growth of
(i) $n^3 + n^2$
(ii) $100000n^3 + n^2$

(iii) $n^3 + 10000n^2$

(iv) $(n^2+1)*(n+1)$

(g) List three major principles of algorithm design.   (3 Marks)

(h) Given the following list of numbers, 3, 41, 52, 26, 38, 57, 9, 49 illustrate how merge sort works.
                                                                             (5 Marks)

(a) Differentiate between breadth-first and depth first in graph data structure, use an appropriate illustration. (4 Marks)

PART B: ANSWER ANY TWO QUESTIONS

QUESTION TWO (20 MARKS)

a) With the help of well-labeled diagrams, demonstrate the following operations on a stack.

(6 Marks)

POP ()

Push ()

(b) Briefly describe ENQUEUE () and DEQUEUE operations on Queue. (4 Marks)

(c) Using big oh notations, Give the time performance for the following. (3 Marks)

(i) Selection sort

(ii) Bubble sort

(iii) Quick Sort

(d) Consider a hash table of size 7 with hash function h (k) = k mod 7. For each of the collision handling methods below, illustrate the results after resolving collision for the values: 19, 26, 13, 48, 17 using (7 marks)

   i.   separate chaining

   ii.   linear probing

   iii.   double hashing using a second hash function h'(k)=5-(k mod 5)

QUESTION THREE (20 MARKS)

(a) Given the following list data set, 54, 26, 93, 17, 77, 31, 44, 55, 20, use quick sort to arrange in ascending order. (10 Marks)

(b) Give the algorithm for the quick sort in 3(a) above. (10 Marks)

QUESTION FOUR (20 MARKS)

(a) Given the graph below:
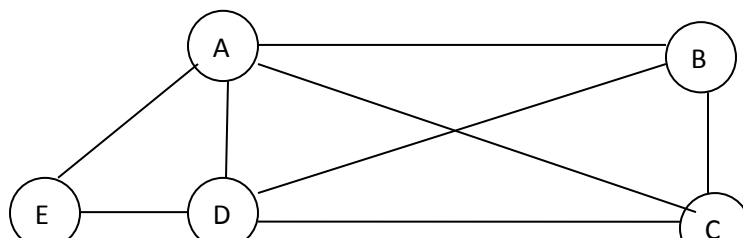
(i) Give the adjacency list. (5 Marks)

(ii) Give the adjacency matrix. (5 Marks)

(b) Write an algorithm for deleting an element x from a liked list. (5 Marks)

(c) Differentiate between dynamic programming and greedy algorithms. (5 Marks)

QUESTION FIVE (20 MARKS)

(a) Given the following data set 14, 33, 27, 10, 35, 19, 42, 44,

Sort the list using insertion sort (Clearly explain each step) (10 Marks)

(b) What is the importance of algorithm analysis? (5 Marks)

(c) Show that for any real constants a and b, where b>0 $(n+a)^b = \Theta(n^b)$ (5 Marks)