

**W1-2-60-1-6**

## JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY

**UNIVERSITY EXAMINATIONS 2020/2021**

**EXAMINATIONS FOR THE FOR THE DEGREE OF BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY**

**ICS 2105: DATA STRUCTURES AND ALGORITHMS**

**DATE: JANUARY 2021 TIME: 2 HOURS**

QUESTION ONE

ai) A woman sells vegetables at a local market. Her grandson is developing a simple stock management application for her vegetable stock. What data structure should he use to manage the stock of vegetable such that she always has the freshest vegetable in her stall? Explain (5 marks)

bi) Define the term data structure (2 marks)

ii) List four characteristics of Data Structures (4 marks)

ci) Differentiate between priori and posterior analysis of algorithms (6 marks)

di) Distinguish between the greedy approach and the divide and conquer approach to algorithm design. Give examples of this approach (6 marks)

ii) State any three factors that influence your choice of an algorithm? (3 marks)

iii) Evaluate the time complexity of the following code segment (4 marks)

sum=0; n=5

for (i=0; in; i++) 

j=i ;

for (j=n ; j0 ; j --) 

sum=sum + i ;





QUESTION TWO

ai) What is an Array Data Structure (2 marks)

ii) State and explain 2 properties of an abstract data structure (4 marks)

bi) Write a pseudo code algorithm that prompts the user for three integers (N1, N2, N3)

(4 marks)

ii) Implement the algorithm you formulated in question 2 in a high level language (4 marks)

QUESTION THREE

ai) Define the term ADT (2 marks)

ii) Write an algorithm that demonstrates the Pop and Push operations of a stack ADT

(8 marks)

iii) Briefly explain any two applications of stack in computer science (4 marks)

bi) Define what a spanning the is and hence its properties (6 marks)

QUESTION FOUR

a) The merge sort algorithm is stated as follows:

If we are inquired to sort an array, we can divide the array into two sub-arrays of about equal length, sort each sub-array separately, and finally merge the two sub-array. Write a method that accepts an unsorted integer array and uses the above algorithm to sort the array. (10 marks)

b) The basic operation of the insertion sort is insertion of a single element into a sequence of sorted elements so that the resulting sequence is still sorted. The process is illustrated below for any array of five integers. The original array is shown in (i)

i) 235 45 182 205 390

ii) 45 235 182 205 390

iii) 45 182 235 205 390

iv) 45 182 205 235 390

Write a method that accepts as a parameter an array of integers and uses this algorithm to sort the elements in the array (10 marks)

QUESTION FIVE

a) Using the data structure below, answer the following questions.

1. What type of ADT is displayed above? (1 mark)
2. Find the root of the above ADT (1 mark)
3. Sibling of M (1 mark)
4. Pre-order traversal (3 marks)
5. Post order traversal (3 marks)

b) Consider the following program

#include (stdio.h)

voidd main () 

int LA []=1, 3, 5, 7, 8

int K=3, n=5 ;

int i, j ;

while (jn) 

LA [j-1]=LA [j] ;

j=j+1 ;



n=n-1 ;

for (i=0 ; in ; i++) 

print f (“LA[%d]=%d\n”, I, LA [i])

;





What does the code print? Dry run to show your answer (11 marks)