THE POLYTECHNIC, IBADAN
DEPARTMENT OF COMPUTER STUDIES
SECOND SEMESTER EXAMINATION 2020/2021 SESSION

COURSE CODE: COM 124
COURSE TITLE: DATA STRUCTURE AND ALGORITHMS
CLASS: ND I COMPUTER SCIENCE FT & DPP
TIME: 2 HOURS
INSTRUCTION: *ANSWER ANY OTHER FIVE QUESTIONS*

Question One

a. Define the following terms:
i. Data ii. Data structure ii. Record iv. Algorithms
b. Outline any four (4) factors that determine the choice of data structure for a particular problem

c. With the aid of a relevant example, describe the best case, average case and worst case of a particular algorithm

Question Two

a. What is sorting?
b. Differentiate between internal sorting algorithms and external sorting algorithms
c. Given an array A of n dimensions, A (L_1:U_1, L_2:U_2, L_3:U_3, ...L_n:U_n),
i. State the general formula to calculate the number of elements in A (2:4, 3:5, 4:7)
ii. Find the number of elements in array A (2:4, 3:6, 6:9)
iii. List out the elements in A in Lexicographic ordering

Question Three

a. State the uses of stacks
b. The STACK below is allocated 8 memory cells, describe the stack as the following operations takes place
STACK : A, C, D, F, K, _ , _ , _
i. POP(STACK, ITEM)
ii. POP(STACK, ITEM)
iii. PUSH(STACK, L)
iv. PUSH(STACK, P)
v. POP(STACK, ITEM)
vi. PUSH(STACK, R)
vii. PUSH(STACK, S)
viii. POP(STACK, ITEM)
c. Considering 2b above i. when will overflow occur? ii. when will C be deleted before D?

Question Four

a. Define the following data structure operations
i. insertion ii. searching iii. traversing iv. merging
v. sorting vi. concatenation

b. Describe the following algorithm approaches into some details
   i. Brute force algorithm ii. Divide and conquer iii. Greedy algorithm
c. Why is the knowledge of data structures important for programmers?

Question five

a. a. Classify the following into linear and nonlinear data structures
   i. Tree ii. Stack iii. Queue iv. Linked list v. graph vi. Array
b. Given an array K (1:4, 1:7) and given that the base address is 140, find the location of elements
   i. K (2,4)
   ii. K (3,7)
c. Explain any <u>four (4)</u> factors that are necessary to be considered when designing an algorithm

Question Six

a. a. Define the following conditions in relation to stack operations
   i. overflow ii. underflow
b. Document the procedure to
   i. Push an element into a stack
   ii. Pop out the top element of a stack
c. Briefly describe any <u>four (4)</u> characteristics of an algorithm

Question Seven

a. Document the benefits of data structure
b. Consider the following queue of characters, where QUEUE is a circular array which is allocated six memory cells:

   FRONT = 2, REAR = 4 QUEUE: __, A, C, D, __, __.

   Note that __ denote empty memory cell

   Describe the queue as the following operations take places:

   i. F is added to the queue
   ii. Two letters are deleted
   iii. K, L and M are added to the queue
   iv. Two letters are deleted
   v. R is added to the queue
   vi. Two letters are deleted
   vii. S is added to the queue
   viii. Two letters are deleted
   ix. One letter is deleted
   x. One letter is deleted

c. State <u>two (2)</u> disadvantages of mapping functions