NATIONAL SCHOOL OF BUSINESS MANAGEMENT

B.Sc. in Computer Science

1st Year 1st Semester Examination-Special Repeat

22-September-2020

CS106.3 – Data Structures and Algorithms

Instructions to Candidates

1) This paper consists of 2 sections. Answer ALL questions.
2) Time allocated for the examination is three and half (3.5) hours.
3) Total number of pages Seven (07) including the MCQ marking grid.
4) If a page or a part of this question paper is not printed, please inform the Supervisor immediately.
5) Write your index number in all pages of answer script.

PART A: Multiple Choice Questions. Transfer your answer to answer script. (25*2=50 Marks)

Refer to below code snippets and answer question 1 to 3.

```
//TYPE A
void A(int a){
        if(a>0){
                printf("%d", a);
                A(a-1);
        }
}
void main(){
        int x=4;
        A(x);
}
```

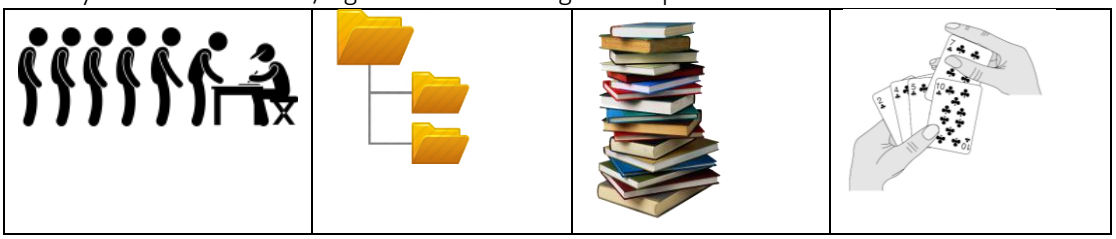
```
//TYPE B
void A(int a){
        if(a>0){
                A(a-1);
                printf("%d", a);
        }
}
void main(){
        int x=4;
        A(x);
}
```

1. What is the programming concept below codes represents?
   a) Backtracking
   b) Divide and Conquer
   c) Recursion
   d) Iterative

2. What is the output of TYPE A?
   a) 1,2,3,4
   b) 1,2,3
   c) 4,3,2,1
   d) 3,2,1

3. What is the output of TYPE B?
   a) 1,2,3,4
   b) 1,2,3
   c) 4,3,2,1
   d) 3,2,1

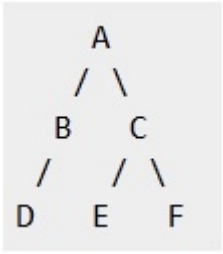
4. Identify the data structure/algorithm below diagrams represents:



   a) Queue, Stack, Tree, linear Search
   b) Queue, Stack, Tree, insertion sort
   c) Queue, Tree, Stack, linear Search
   d) Queue, Tree, Stack, insertion sort

5. Perfect binary tree is a full binary tree and every full binary tree is also a perfect binary tree. This statement is:
   a) True
   b) False

Consider the following graph representation and related Breadth First Search (BFS) and Depth First Search (DFS) algorithms to answer questions from 6 to 9. Starting point is "A" and this follows alphabetical order.



6. What data structure is used to derive BFS output

a) Queue
b) Stack
c) Tree
d) Array

7. What data structure is used to derive DFS output

a) Queue
b) Stack
c) Tree
d) Array

8. What is the output of BFS?

a) A, B, C, D, E, F
b) A, B, D, C, E, F
c) A, C, E, F, B, D
d) None of the G

9. What is the output of DFS?

a) A, B, C, D, E, F
b) A, B, D, C, E, F
c) A, C, E, F, B, D
d) None of the

10. The number of interchanges required to sort 5, 1, 6, 2, 4 in ascending order using Bubble Sort is

a) 5
b) 7
c) 8
d) 6

11. Show the first pass/round output of bubble sort on an unsorted array: [11, 15, 2, 13, 6]

a) 11 2 13 6 15
b) 11 2 15 13 6
c) 11 2 6 13 15
d) 2 6 11 13 15

12. What is the data structure you can use to evaluate postfix expressions?

a) Queue
b) Stack
c) Tree
d) Array

13. If you use above structure to solve the below expression consisting of tokens what would be the final answer 2 3 1 * + 9 -

a) 4
b) -2
c) -4
d) 2

14. In a queue, the initial values of front pointer f rear pointer r should be …….. and …….. respectively.

a. 0 and 1
b. 1 and 0
c. 0 and -1
d. -1 and 0

15. Let the following circular queue can accommodate maximum six elements with the following data

front = 2 rear = 4
queue = _____; L, M, N, ___, ___

What will happen after ADD O operation takes place?

a) front = 2 rear = 5
b) front = 2 rear = 4
c) front = 3 rear = 5
d) front = 3 rear = 4

16. Using 512 nodes you can create a perfect binary tree

a) True
b) False

17. Given an array arr = {5,6,77,88,99} and key = 88; How many iterations are done until the element is found using bubble sort?

a) 1
b) 3
c) 2
d) 4

18. Consider the situation in which assignment operation is very costly. Which of the following sorting algorithm should be performed so that the number of assignment operations is minimized in general?

a) Insertion Sort
b) Selection Sort
c) Bubble Sort
d) None of the given

19. Two main measures for the efficiency of an algorithm are

a) Processor and memory
b) Complexity and capacity
c) Time and space
d) Data and space

20. You can create a binary tree using 217 nodes

a) True
b) False

21. The searching technique that takes O (1) time to find a data is

a) Insertion to unordered array
b) Insertion to ordered array
c) Deletion in unordered array
d) Deletion in ordered array

22. Linked lists are best suited

a. for relatively permanent collections of data
b. for the size of the structure and the data in the structure are constantly changing
c. for fixed size memory
d. For all the above situations

23. Each node in a linked list has two pairs of ..... and .....

a. Link field and information field
b. Link field and Next field
c. Data field and information field
d. Address field and link field

24. In Big O notation complexity analysis is O(1) better than O(N).

a) True
b) False

25. The complexity of searching an element from a set of n elements using Binary search algorithm is

a) O(n)
b) O(log n)
c) $O(n^2)$
d) O(n log n)

Question 01: Searching algorithms aim to find position of a target value within an array/list.

(5+5+5 = 15 Marks)

I. Compare and contrast linear and binary search algorithms.
II. Search for value 65 on the [15,60,45,13,65,75] array using binary search algorithm. Note that the illustrations and labels are mandatory.
III. Write a function using pseudo or source codes for searching an integer variable called *item* using linear search in an array called *unorderedArray*.

Question 02: Sorting algorithms aim to arrange a data set in an ordered manner **(6+4+5 = 15 Marks)**

I. Briefly explain bubble sort and selection sort algorithms?

II. Diagrammatically perform the bubble sort on the following array.

I. 29	II. 10	III. 14	IV. 37	V. 13

III. Sort the following sequence of keys using merge sort (Diagrammatically show the steps)

i. 66, 77, 11, 88, 99, 22, 33, 44, 55

Question 03: A tree is a widely used abstract data structure that is also non-linear format storing data in a hierarchical structure. **(5 + 5 + 6 + 4 = 20 Marks)**

I. Draw a binary tree by your own and identify the root, siblings, leaves, edges, height and paths of the above tree data structure.
II. Given a binary search tree (BST) [50, 45, 27, 8, 65, 100, 82, 2, 90] find the sum of all leaf nodes.
III. Derive the preorder, post order and in order traversal output of the above BST structure.
IV. Derive the output of the below code. Show steps.

```
#include <stdio.h>

int fun(int n)

{

  if (n == 4)

  return n;
```

```
    else return 2*fun(n+1);
}
int main()
{
    printf("%d ", fun(2));
    return 0;
}
```

END OF THE PAPER