Department of Information and Communication Engineering
Pabna University of Science and Technology
Faculty of Engineering and Technology
B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2022
Session: 2020-2021, 2019-2020

Course Code: **ICE-2201** Course Title: **Data Structure and Algorithm**

NB:
1. Answer any **SIX** (THREE from each PART) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) Differentiate between data type and data structure. Why should you have good knowledge on data structures as an ICE student? 4
   b) How does a point array can save memory when stores a variable sized group of data? Discuss with necessary figures. 3
   c) An array ICE[-4.....6, -2.....12], stores elements in Row Major Wise, with the address ICE[2][3] as 4142. If each element requires 2 bytes of storage, find the Base address. $4\frac{2}{3}$

2. a) Define AVL search tree. Explain LL rotation and RR rotation for the balancing of an AVL search with example. 5
   b) What is m-way search tree? Insert the following keys in the order shown below into an initially empty m-way search tree of order 4. $6\frac{2}{3}$

   G S F L Q X Z V R A I J W

3. a) Explain the linked representation of the graph. $6\frac{2}{3}$
   b) Write down the algorithm for topological sorting. Explain it with a graph. 5

4. a) Explain different pass of selection sort algorithm using some data items. Find the complexity of selection sort algorithm. $6\frac{2}{3}$
   b) Consider the following 4-digit employee numbers 5
   9814, 7887, 4793, 5509, 7249.
   Find the 2-digit hash address of each number using
   I) the division method with $m = 97$;
   II) the midsquare method.

PART-B

5. a) Define an algorithm. Explain the features of an efficient algorithm. 3
   b) Explain briefly Big oh, Big omega and Big Theta notation. $3\frac{2}{3}$
   c) Derive the recurrence relation for Fibonacci series algorithm and carry out the time complexity analysis. 5

6. a) State the general principle of Brute Force and Divide and Conquer approach. 2
   b) How many comparisons will be made by the brute force string matching algorithm in searching for each of the following patterns in the binary text of 1000 zeros? I) 00001 II) 10000. 4
   c) Write down the algorithm to construct a convex hull based on divide and conquer strategy. $5\frac{2}{3}$

7. a) Algorithms A and B spend exactly $T_A(n) = C_A n log_2 n$ and $T_B(n) = C_B n log_2 n$ microseconds respectively, for a problem size n. Find the best algorithm for processing $n = 2^{20}$ data items if the algorithm A spends 10 microseconds to process 1024 items and the algorithm B spends only 1 microsecond to process 1024 items. 3

b) What do you mean by dynamic programming? Given two sequences of characters, find out the length along with procedure of the longest common subsequence of both sequences BDCAB and ABCBD. $3\frac{2}{3}$

c) Draw a state transition diagram for the string matching automation that accepts all strings ending in the string "acabaca". 5

8. a) Devise an algorithm to make for 1655 using the greedy strategy. The coins available are {1000, 500, 100, 50, 20, 10, 5}. 4

b) What is N-Queen's problem? Draw the state space tree for 4-queen's problem. 4

c) Consider a set $S = \{5, 10, 12, 13, 15, 18\}$ and $sum = 30$. Use the backtracking model to arrive at the solution of this sum of subset problem. $3\frac{2}{3}$