

International Islamic University Chittagong
Department of Computer Science & Engineering
B. Sc. in CSE Semester Final Examination, Spring 2018
Course Code: CSE 2303 Course Title: Data Structures
 Total marks: 50 Time: 2:30 hours

[Answer any *two* questions from **Group-A** and any *three* question from **Group-B**;
 Separate answer script must be used for Group-A and Group-B;
 Figures in the right hand margin indicate full marks.]

Group-A

1. a) What is linked list? What are the advantages and disadvantages of linked list over the linear array 2.5
- b) Write an algorithm to search a linked list when the list is sorted. 3
- c) Consider the *alphabetized* list of patients in Figure 1. Determine the changes in the data structure 2
 if i) Jones is added to the list and then ii) Max is deleted from the list.

					START 5							
					↓							
										AVAIL 10		
					↓					↓		
	1	2	3	4	5	6	7	8	9	10	11	12
BED	Kirk		Dean	Max	Adam		Lane	Green	Samu		Fields	Nelso
Link	7	6	11	12	3	0	4	1	0	2	8	9

Figure 1

- d) What is two way lists? Form a two way lists from the one way list in Figure 1. 2.5
2. a) Let M and N be integers and suppose $F(M, N)$ is recursively defined by 4

$$F(M, N) = \begin{cases} 1 & \text{if } M=0 \text{ or } M \geq N \geq 1 \\ F(M-1, N) + F(M-1, N-1) & \text{Otherwise} \end{cases}$$
 Find the value of $F(4, 2)$ and $F(2, 4)$
 - b) Suppose a queue is maintained by a circular array QUEUE with $N=12$ memory cells. Find the number of elements in QUEUE if (i) $\text{Front}=4$, $\text{Rear}=8$ and (ii) $\text{Front}=10$, $\text{Rear}=3$ 2
 - c) The following list of names is assigned (in order) to a linear array INFO: 4
 Mary, June, Barbara, Paula, Diana, Audrey, Karen, Nancy, Ruth, Eileen, Sandra, Helen, That is
 $\text{INFO}[1]=\text{Mary}$, $\text{INFO}[2]=\text{June}$,, $\text{INFO}[12]=\text{Helen}$. Assign values to an array LINK and a variable START so that INFO, LINK and START form an alphabetical listing of the names.
3. a) Let A and B be non negative integers. Suppose a function GCD is recursively defined as follows- 2

$$\text{GCD}(A, B) = \begin{cases} \text{GCD}(B, A) & \text{if } A < B \\ A & \text{if } B = 0 \\ \text{GCD}(B, \text{MOD}(A, B)) & \text{Otherwise} \end{cases}$$
 Here MOD (A, B) denotes the remainder when A is divided by B.
 - i) Find $\text{GCD}(6, 15)$, $\text{GCD}(20, 28)$ and $\text{GCD}(540, 168)$, (ii) What does this function do? 2
 - b) Write a recursive procedure for the solution of the *Towers of Hanoi* problem. 3
 - c) Let LIST be a *linked list* of integers in memory. Write a procedure to find the *maximum* MAX of 3

the values in LIST.

- d) What is *circular header list*? Write the advantages of circular header list over ordinary linked list. 2

Group-B

4. a) What do you mean by complexity of an algorithm? Analyse the complexity of insertion sort algorithm. 3

- b) Find the total number of exchanges when you implement the selection sort algorithm to the following list of numbers. 4

<74, 33, 44, 11, 88, 22, 66, 55, >

- c) Show the operation of the merge sort algorithm on the following array 3
A = <44, 33, 11, 55, 77, 90, 40, 60, 99, 22, 88, 66>

5. a) Consider the algebraic expression $E = (3m + n)(5x - y)^3$. 4

a) Draw the tree T which corresponds to the expression E.

b) Find the *preorder* and *postorder* of T.

- b) A *binary tree* T has 9 nodes. The *inorder* and *preorder* traversals of T yields the following sequences of nodes: 3

Inorder : E A C K F H D B G

Preorder : F A E K C D H G B

Draw the tree T.

- c) What is a *binary search tree*? Suppose the following eight numbers are inserted in order into an empty binary search tree. 3

40 23 34 22 77 45 60 50

i) Draw the tree T, ii) Find the *inorder* traversal of T.

6. a) What is a *graph*? Consider the following graph G in figure 2: 3

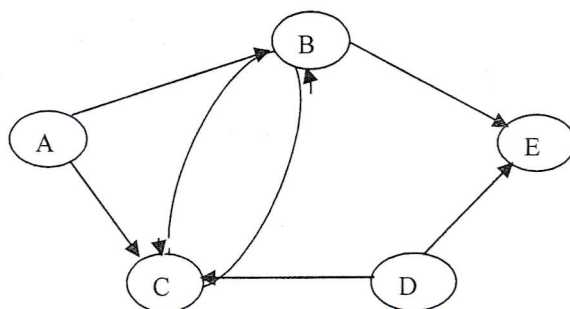


Figure 2

i) Find the *adjacency matrix* A of the graph G.

ii) Find the *adjacency list* of the graph G.

- b) What is *path matrix*? Consider the graph G in Fig-1. Find the path matrix P of G using *Warshall's algorithm*. Compute the matrices P_0, P_1, P_2, P_3, P_4 and P_5 . 4

- c) What are the two standard *graph-traversing algorithms*? Briefly describe any one of these algorithms with example. 3

7. a) What is Hash function? Illustrate the three popular Hash function. 3

- b) Suppose the following list of letters is inserted in order into an empty binary search tree: 4

J, R, D, G, T, E, M, H, P, A, F, Q

(i) Find the final tree T, (ii) Find the *inorder* traversal of T.

- c) Define following terms with necessary figure. 3

(i) Digraph (ii) Adjacent vertices (iii) Self loop (iv) Complete graph (v) Connected graph
(vi) Isolated vertex