United International University (UIU)

Dept. of Computer Science and Engineering (CSE)

Final Exam   Year: 2023   Trimester: Fall

Course: CSE 2215 Data Structure and Algorithms I

Total Marks: 40, Time: 2 hours

(Any examinee found adopting unfair means will be expelled from the trimester / program as per UIU disciplinary rules)

There are FOUR questions. Answer all of them. Figures in the right-hand margin indicate full marks.

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1. a) Which Data Structures are appropriate to implement the following and why? [3]
    i) Matrix representation
    ii) Bus Ticket Counter
    iii) Different locations of Dhaka City with a distance from one another

    b) Convert the following infix expression into postfix using a STACK. [4]
    Infix expression: $a\uparrow2-(b+c/d*a+b)$

    c) Evaluate the postfix expression, a b – c d * + for a=2, b=3, c=2 and d=1. [3]

    d) Design an iterative algorithm for TOWER OF HANOI using one intermediate pillar/peg and show simulation for n = 2, where n is the number of disks. [3]

2. a) Show the manual tracing of the following algorithm using the given Queue of size 3. Here, Queue is a FIFO data structure, and m, f and r are size, front and rear of the Queue, respectively. What is the purpose of the algorithm? [3]

Queue	32	30		31
	0	r=1	f=2	3

    ```
    i=(f+1)%(m+1);
    while( i!=f ){
        printf("%d   ", Queue[i]);
        i=(i+1)%(m+1);
    }
    ```

    b) Show the status of a QUEUE and a Priority QUEUE (Data in Descending Order) for the following operations, where both QUEUEs are implemented by an array of size, m=3. Here, Enqueue and Dequeue mean insert and delete respectively, and x=last two digits of your student id+4, y=x+3, z=x+y and p=y+z. [3]

    Enqueue(z), Enqueue(p), Dequeue(), Enqueue(y), Enqueue(z)

    c) Find a min-heap tree from the following data where ID=last two digits of your student ID. Show step by step procedure during construction of the tree. [3]

    10   40   20   8   99   ID   15   17

3. a) Draw a directed acyclic graph with six vertices. [1]

    b) Show the simulation of the Topological Ordering Algorithm using the graph in Ques. 3(a). [4]

    c) Draw a binary tree using the data given below, where x, y, z, p, r, t, u and v are nodes of the tree. [1]
    y p z x r t u v

Here, x=last digit of your student id+5, y=x+3, z=x+y, p=y+z, r=x+2, t=p+r, u=r+t, v=t+u

d) How can you represent the binary tree of Ques. 3(c) using one dimensional array and linked list? [2]

4. a) Draw a binary tree from the following Inorder and Postorder sequences [2]

        Inorder: v p y r x t z u
        Postorder: v p r y t u z x

Here, x=last digit of your student id+5, y=x+3, z=x+y, p=y+z, r=x+2, t=p+r, u=r+t, v=t+u

b) Construct a binary search tree (BST) using the nodes y, p, z, x, r and t, where x=last digit of your student id+5, y=x+3, z=x+y, p=y+z, r=x+2, t=p+r. Show the insertion and deletion of r+t and y, respectively in/from the BST. [4]

c) Two disjoint sets {y, p, z, x} and {r, t} are given, where minimum one of a set is the representative of that set. Determine UNION(Find(x), Find(t)). How can you check x and y are in the same set using Find operation? Here, x=last two digit of your student id+5, y=x+3, z=x+y, p=y+z, r=x+2, t=p+r. [2]

d) Develop an idea to check whether addition of an edge in a binary tree forms a cycle or not using Find operation. [2]