United International University
Department of Computer Science and Engineering

CSI 217:Data Structure Final Exam : Summer 2017

Total Marks: 40 Time: 2 hours

There are SIX questions. Answer any FOUR. Figures in the right-hand margin indicate full marks.

1. (a) Define graph, cycle and connected graph with example. (3)

   (b) Show the adjacency matrix and adjacency list for the graph in **Figure Q. 1(b)**. (3)

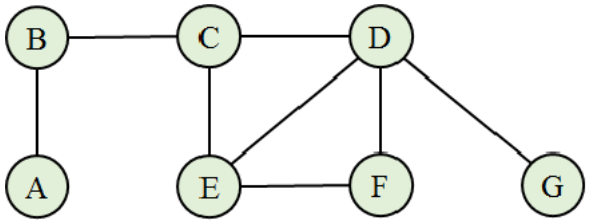

Figure: 1(b)

   (c) Using **linear probing** (looking for the next available location i+1, i+2, etc. from the hashed value i) to resolve collisions, insert the keys 26, 51, 24, 15, 33, 18, 17, 79 into a hash table of thirteen slots using following hash functions: (4)

   h(k) = (Rev(k + 1) mod 11)

   Here, function Rev(k) reverses the decimal digits of k, for example, Rev(37) = 73

2. (a) What are the advantages of postfix expression over infix expression? (2)

   (b) Convert the following infix expression into postfix using STACK and evaluate the postfix expression for the given values: (5+3=8)

   Infix expression: ((A + B) * (C - D) + E) / (F + G)

   Given values: A=1, B=5, C=10, D=12, E=2, F=3, G=7

3. Suppose we create a binary search tree by inserting the following values in the given order: 50, 10, 13, 45, 55, 110, 5, 31, 64, and 47. Answer the following questions: (5*2=10)

   (a) Draw the binary search tree.

   (b) Show the output values if we visit the tree using pre-order traversal technique.

   (c) Show the output values if we visit the tree using post-order traversal technique.

   (d) Show the output values if we visit the tree using in-order traversal technique.

   (e) Show the resulting trees after we delete 47, 110, and 50. **(Each deletion is applied on the successive resultant tree.)**

4. (a) Design a recursive algorithm to solve TOWER OF HANOI problem using one intermediate pillar/peg and draw the recursive function call tree for n=3, where n is the number of disks. (4)

   (b) As a function of n (no of disks), how many disk moves (minimum) are necessary to solve the TOWER OF HANOI problem if there are only three pillars. (3)

   (c) Write an algorithm to represent the **Enqueue** and **Dequeue** methods of implementing a Queue using two Stacks, named **inputStack** and **outputStack**. (3)

5. (a) What are the applications of a QUEUE in real life? (2)

   (b) Suppose that you are given the following doubly linked list implementation: (5)

```
struct listNode {
        int item;          //will store data
        struct listNode *next;          //will keep address of next node
        struct listNode *prev;          //will keep address of previous node
};
struct listNode * head;          //points to the first node of the list
struct listNode * tail;          //points to the last node of the list
```

Now design a function to print alternate nodes of the given Linked List, first from head to tail, and then from tail to head.
For Linked List: 1 → 2 → 3 → 4 → 5 Output: 1 3 5 5 3 1
For Linked List: 1 → 2 → 3 → 4 → 5→ 6 Output: 1 3 5 5 3 1

(c) Write an algorithm to find out the depth of a given node. (3)

6. (a) Answer the following questions based on the given graph of **Figure 6(a)**: (3.5*2=7)

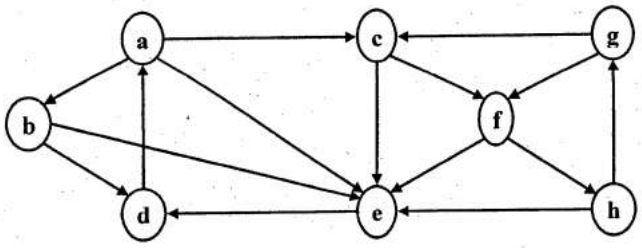

Figure: 6(a)

i. Write the sequences of the vertices if you explore the graph G using BFS.
ii. Do a topological sort on the given graph.

(b) Construct a binary tree from the given traverse result: (3)
Preorder: a b d g h e i c f j
Postorder: g h d i e b j f c a
Inorder: g d h b e i a f j c