



North South University
Department of Electrical and Computer Engineering
Final Assignment, Spring 2021
Data Structure and Algorithm

CSE-225

Section:13

Full marks: 30

Submission guidelines:

- **Write your Name and ID in every page of your script**
- **After you complete the assignment, File Name must be your Name_ID**
- **Any form of cheating will be penalized heavily.**
- **Duplicate will not be marked regardless of which one the original is!**

1. a) Convert **(A+B* (C-D)) /E** into Postfix from showing stack status after every step in tabular form. 3
1. b) Consider the following stack of characters, where STACK is allocated N = 5 memory cells 2

STACK :

4	
3	
2	
1	A
0	B

Describe the stack as the following operations takes place:

- (i) POP(STACK,ITEM)
- (ii) PUSH(STACK, C)
- (iii) POP(STACK, ITEM)
- (iv) PUSH(STACK, D)
- (v) PUSH(STACK, E)
- (vi) POP(STACK, ITEM)

1. c) Suppose you have three stacks s1, s2, s2 with starting configuration shown on the left, and finishing condition shown on the right. Give a sequence of push and pop operations that take you from start to finish. For example, to pop the top element of s1 and push it onto s3, you would write s3.push(s1.pop()). 3

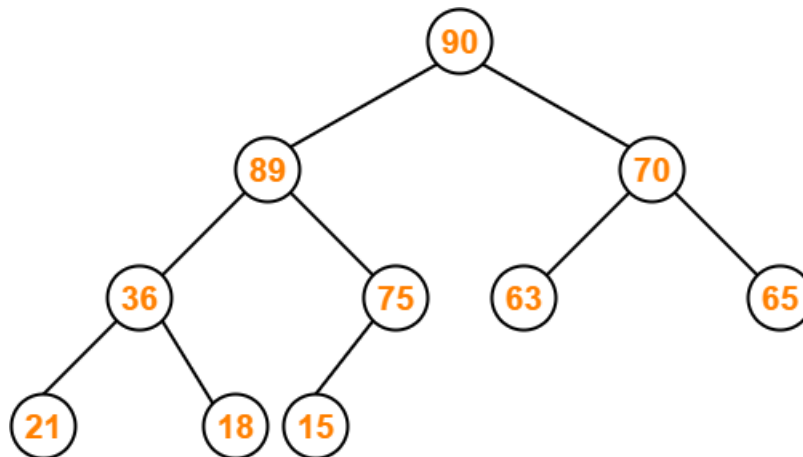
start			finish		
A					C
B					A
C					D
D					E
E					B
---	---	---	---	---	---
s1	s2	s3	s1	s2	s3

1. d) In implementing a Queue using an array, a problem might arise if the Queue is implemented in such a way that items in the Queue are inserted at the next available location and removed from the next leading position, but such that, once deleted, the emptied space is unused. The problem that arises is one where there is free space still in the array, but it is not useable because it is not at the end. Demonstrate this problem with a Queue that is stored in an array of size 5 for the following instructions. Next, explain how you might resolve this problem.

Queue q = new Queue(5); // assume the Queue constructor takes 5 as the size of the array

```
q.enqueue(7);
q.enqueue(13);
q.dequeue();
q.enqueue(16);
q.dequeue();
q.enqueue(11);
q.dequeue();
q.enqueue(15);
q.dequeue();
```

2. a) Given the following max-heap:



Draw the max-heap resulting after deleting one element and inserting 50 and 80

b) The characters bellow have the set of frequencies as follows:

3

a : 25,
c : 12,
d : 3,
i : 17,
o : 11,
n : 13,
r : 7,
v : 4.

A Huffman code is used to represent the characters. Encoding the word “aircond” by huffman code ?

c) Construct a binary tree from the following traversing sequence of integers:

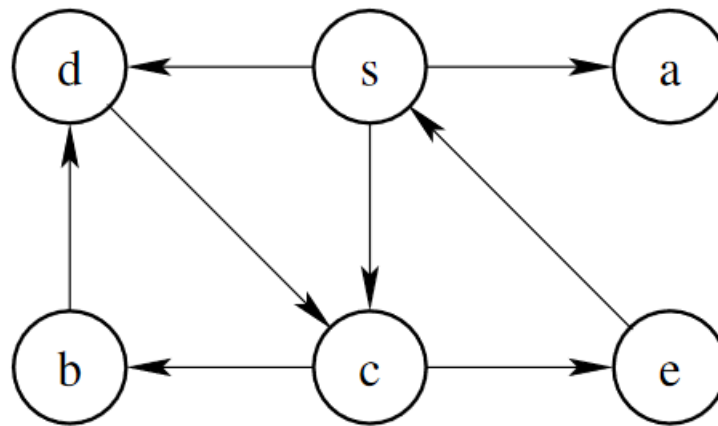
2

Pre-order: 8, 5, 9, 7, 1, 12, 2, 4, 11, 3

in-order: 9, 5, 1, 7, 2, 12, 8, 4, 3, 11

d) Find the adjacency matrix from the following graph

2



2

3. a) Draw the contents of the hash table in the boxes below given the following conditions:

3

The size of the hash table is 12.

Open addressing and quadratic probing is used to resolve collisions.

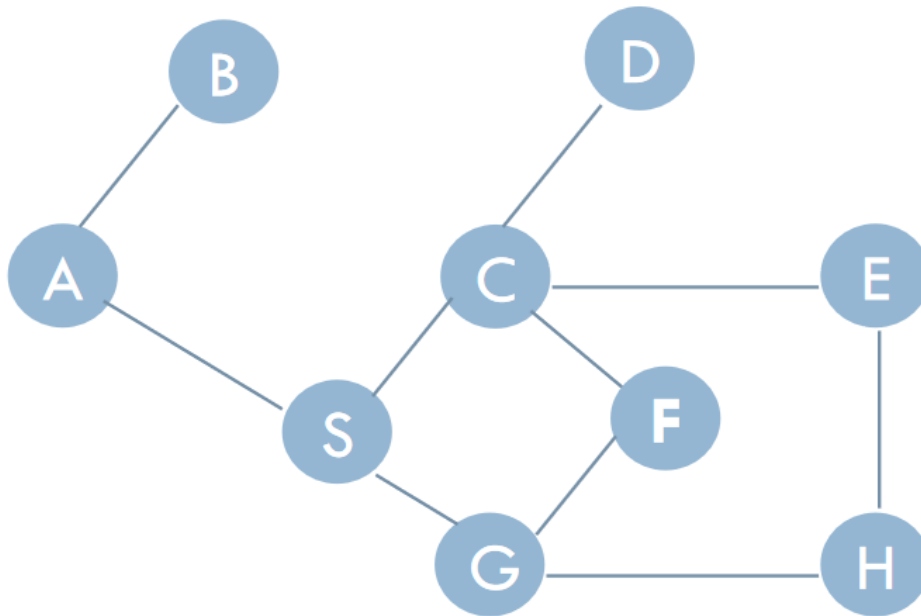
The hash function used is $H(k) = k \bmod 11$

What values will be in the hash table after the following sequence of insertions? Draw the values in the boxes below, and show your work for partial credit.

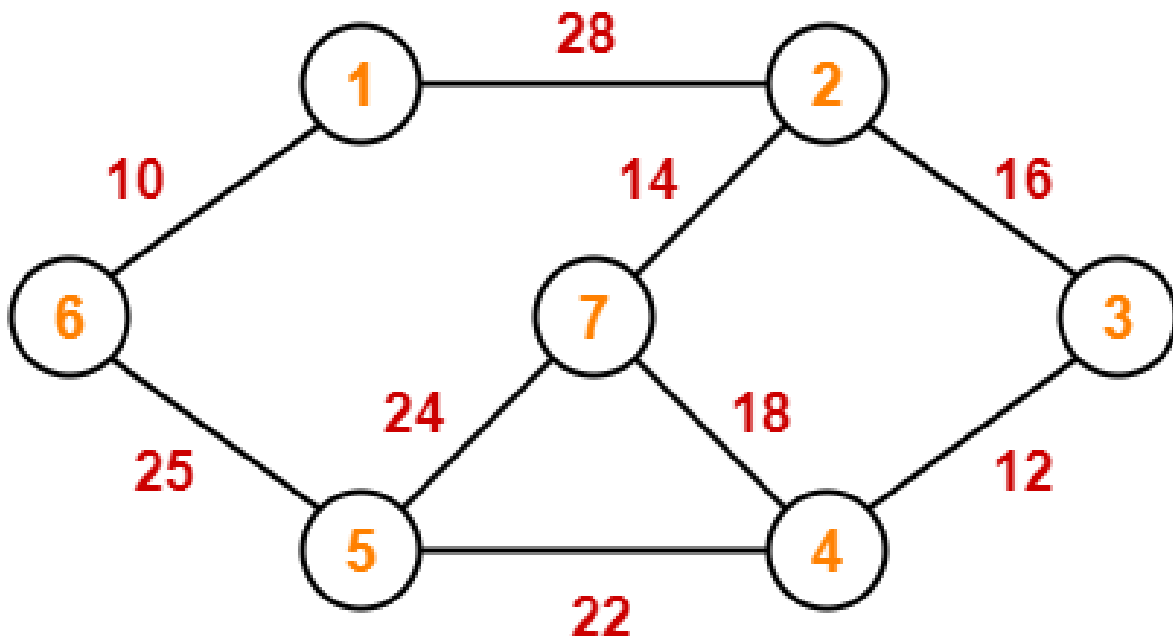
40, 25, 29, 23, 17, 35, 43, 13

0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

- b) Give possible DFS traversals starting from node A of the graph below, printing the nodes both as they are discovered and finished. Note that the graph is undirected; for instance, there is an edge from A to B and also from B to A. 2

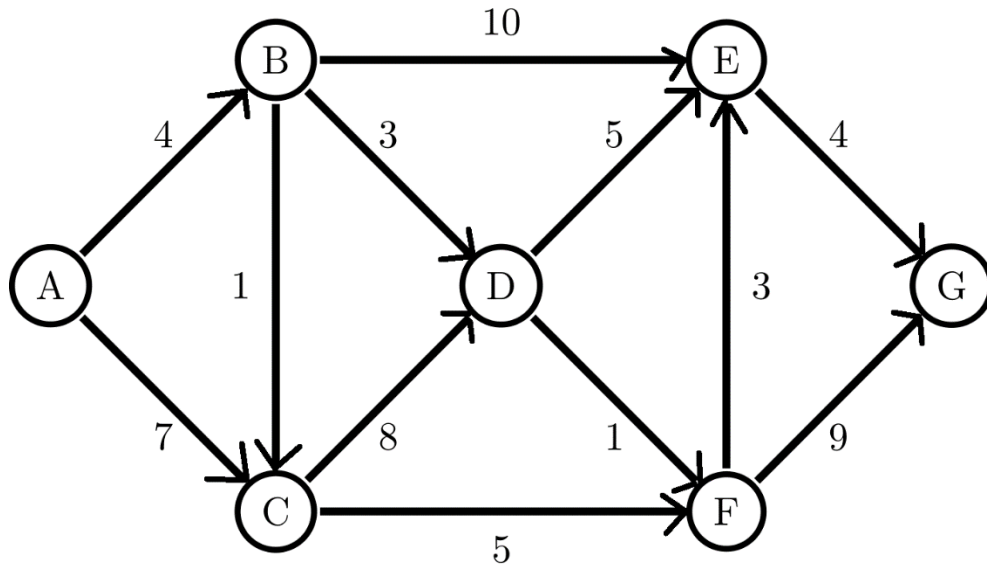


- c) Use Prim's algorithm starting at node 6 to compute the Minimum Spanning Tree (MST) of graph. 2



- d) Use the following graph for this problem. **Where needed and not determined by the algorithm, assume that any algorithm begins at node A.**

3



Step through Dijkstra's Algorithm to calculate the single source shortest path from A to every other vertex. You only need to show your final table, but you should show your steps in the table below for partial credit. Show your steps by crossing through values that are replaced by a new value. [Ref. Graph in figure]

Vertex	Known	Distance	Path
A			
B			
C			
D			
E			
G			

- In what order would Dijkstra's algorithm mark each node as known?
- What is the shortest (weighted) path from A to G?
- What is the length (weighted cost) of the all shortest path