UNIVERSITY OF ENERGY AND NATURAL RESOURCES, SUNYANI, GHANA

SCHOOL OF ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

LEVEL 200 END OF SECOND SEMESTER EXAMINATIONS 2016/2017

Bachelor of Science (Computer Engineering)

CENG 208: DATA STRUCTURES AND ALGORITHMS

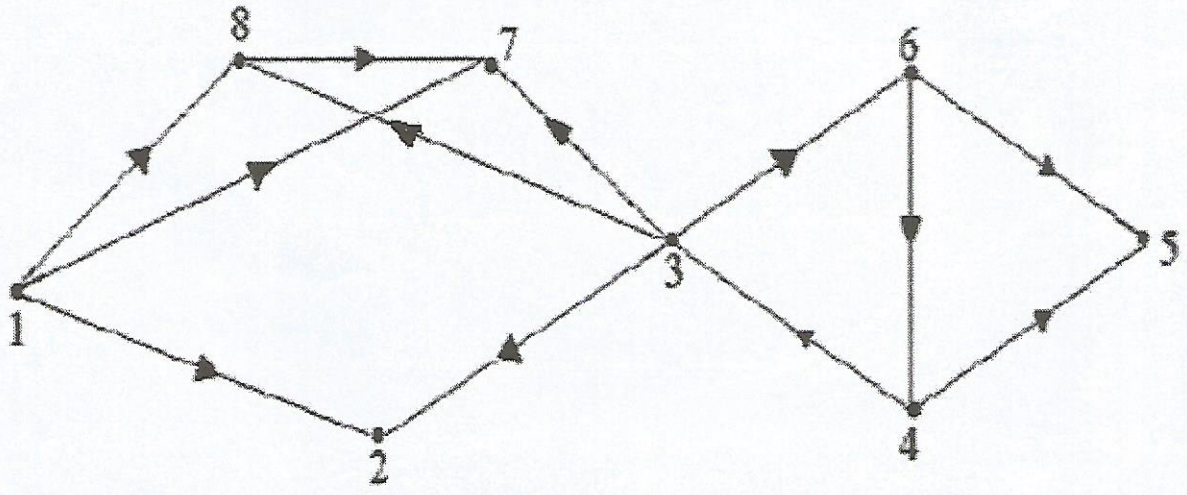
May, 2017 Time: 2 Hours

Materials Required: PEN, PENCIL AND ERASER

Instructions: **ANSWER ALL QUESTIONS**

QUESTIONS

(a) Show the result of running BFS and DFS on the directed graph given below using vertex 3 as source. Show the status of the data structure used at each stage.



[6 Marks]

(b) Two Binary Trees are similar if they are both empty or if they are both nonempty and left and right sub trees are similar. Write an algorithm to determine if two Binary Trees are similar.

[3 Marks]

(c) Define Hashing. How do collisions happen during hashing? Explain the different techniques for resolving collision in hash tables.

[3 Marks]

(d) (i) Explain to a novice what is meant by the complexity of a computer algorithm? Explain the meaning of worst case analysis and best case analysis with an example.

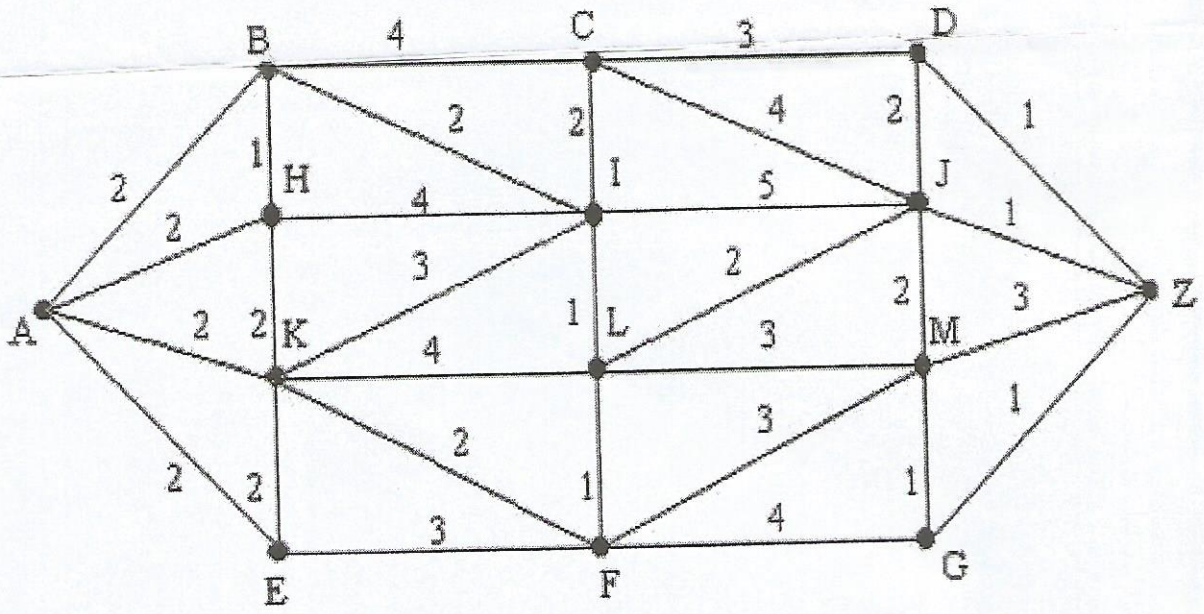
[5 Marks]

(ii) Explain how to implement two stacks in one array A[1...n] in such a way that neither stack overflows unless the total number of elements in both stacks together is n. The PUSH and POP operations should run in O (1) time.

[3 Marks]

QUESTION TWO

(a) Find the shortest path from A to Z using Dijkstra's Algorithm.



[7 Marks]

(b) Draw the 11 item hash table resulting from hashing the keys: 12, 44, 13, 88, 23, 94, 11, 39, 20, 16 and 5 using the hash function h(i) = (2i+5) mod 11.

[3 Marks]

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(c) (i) Let P be a pointer to a singly linked list. Show how this list may be used as a stack. That is, write algorithms to push and pop elements. Specify the value of P when the stack is empty.

[3 Marks]

(ii) The degree of a node in a tree is the number of children it has. Show that in any binary tree, the number of leaves are one more than the number of nodes of degree 2.

[2 Marks]

(d) A double ended queue is a linear list where additions and deletions can be performed at either end. Represent a double ended queue using an array to store elements and write modules for additions and deletions.

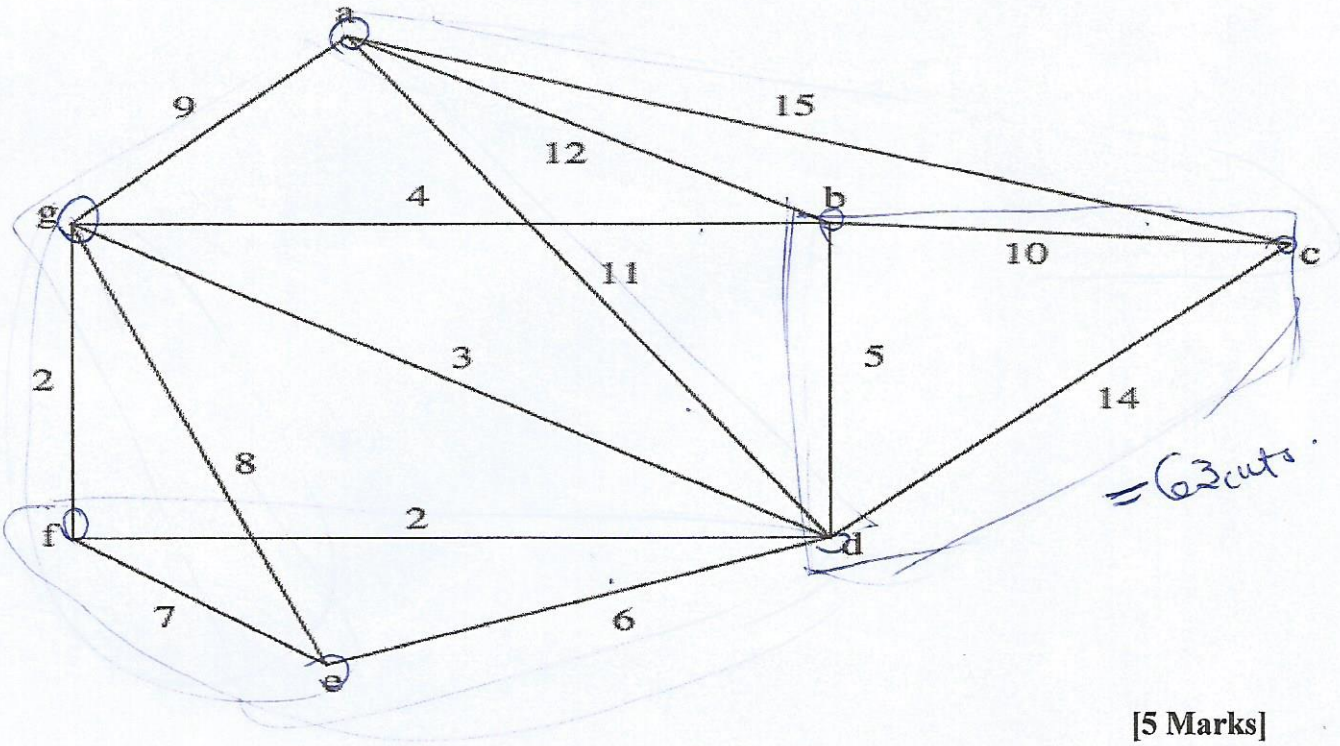
[5 Marks]

QUESTION THREE

(a) Explain with the aid of an example how a multidimensional array can be represented in one dimensional array.

[4 Marks]

(b) What is a Spanning tree of a graph? What is minimum spanning tree? Execute Prim's Kruskal's algorithm to find the minimum spanning tree of the graph below.



[5 Marks]

7 7
5 6
9 5
5

(c) Information to be transmitted over the internet contains the following characters with their associated frequencies as shown in the following table:

Characters	a	e	i	n	o	s	t
Frequency	45	65	13	45	18	22	53

i. Build the Huffman code tree for the message. **[3 Marks]**

ii. Use the Huffman tree to find the code word for each character. **[2 Marks]**

iii. If the data consists of only these characters, what is the total number of bits to be transmitted? What is the percentage saving if the data is sent with 8-bit ASCII values without compression?

[2 Marks]

(d) Bubble sort algorithm is inefficient because it continues execution even after an array is sorted by performing unnecessary comparisons. Therefore, the number of comparisons in the best and worst cases are the same. Modify the algorithm in such a fashion that it will not make the next pass when the array is already sorted.

[4 Marks]