Université Libanaise
Faculté d'Information

Br I

الجامعة اللبنانية
كلية الاعلام
الفرع الاول

الامتحانات النهائية للفصل الثالث
من العام الجامعي 2020-2021

Dalia

المرحلة: الاولى	المادة: هيكلة البيانات والخوارزميات
السنة المنهجية: الثانية	المدة: ساعة ونصف الساعة
الاختصاص: علم البيانات	الأستاذ: د. حياة ناصر

Question 1: Hash table (12 points)

Answer the following questions with justifying your answers:

1. Suppose you have the following hash table, implemented using linear probing. For the hash function we are using the identity function modulo the length of the list, h(x) = x mod 9.

0	1	2	3	4	5	6	7	8
9	18		12	3	14	4	21	

- In which order could the elements have been added to the hash table? There are several correct answers, and you should choose them all.
  a) 12, 3, 14, 18, 4, 9, 21
  b) 12, 9, 18, 3, 14, 21, 4
  c) 9, 14, 4, 18, 12, 3, 21
  d) 9, 12, 14, 3, 4, 21, 18
  e) 12, 14, 3, 9, 4, 18, 21

2. Insert the following numbers in this order in a hash table of size 11 using *linear probing*. Use the following hash function: h(i) = (2i + 5) mod 11
   12 44 13 88 23 94 11 39 20 16

Question 2: LinkedList (31 points)

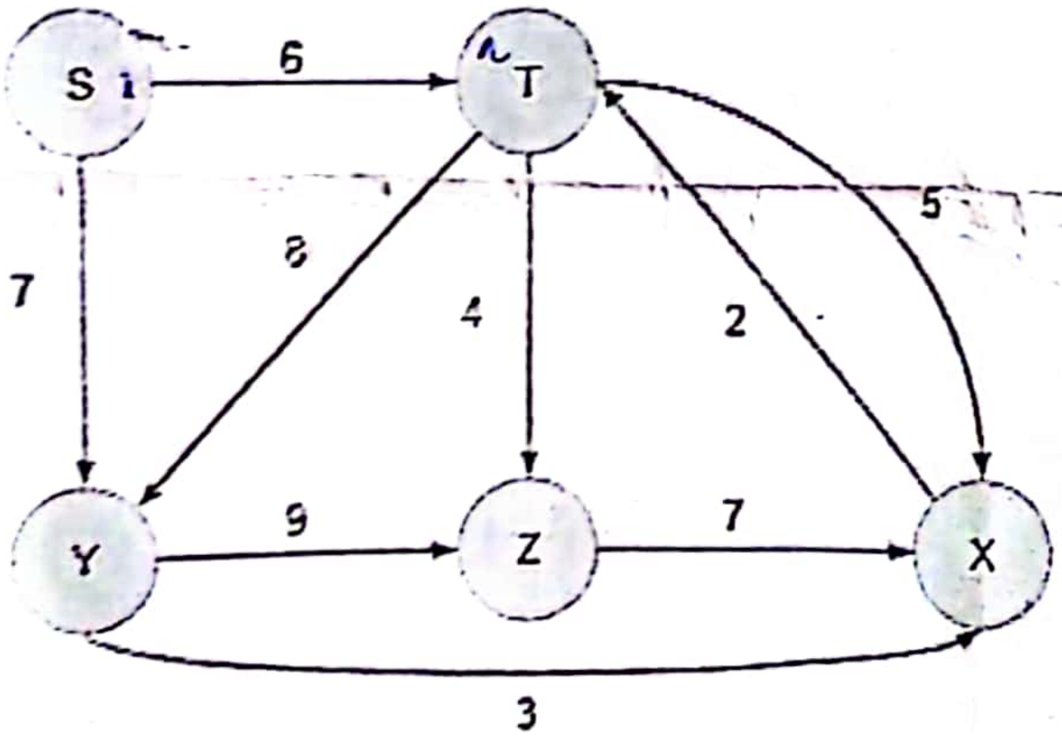
Write a Java program to implement a double linked list. (5 points)
Write methods:
a) addDNode (int val) that adds a node to the list (at the head, at the tail, after a specific DNode given as a parameter in the method). (5 points)
b) remDNode (DList d, int val) that traverses through a doubly linked list and deletes the node with the value val. (5 points)
c) displayForward() that display the list in forward direction. (3 points)
d) displayReverse() that display the list in reverse direction. (3 points)
e) bubleSort() that sort the double linked list using buble sort algorithm. (10 points)

Question 3: Tree (36 points)

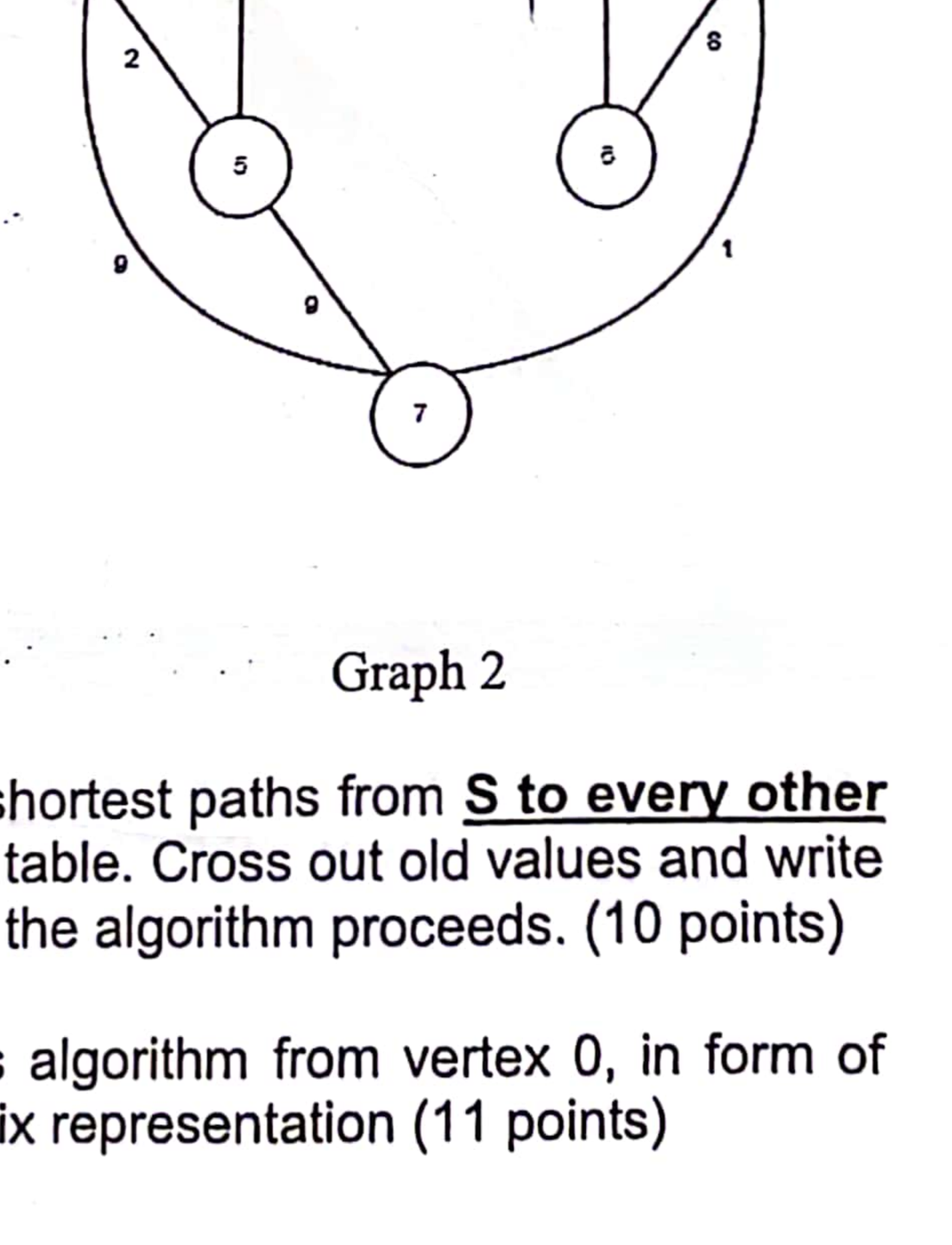
a) Insert the following sequence of numbers into a binary search tree structure 28. 10, 20, 40, 22, 34, 4, 13, 66, 30, 55, 14, 25, 38, 80, 12, 8, 9, 32. (4 points)
b) Remove nodes 13, 28, 55, 10. (4 points)
c) List the different type of traversal tree method and give all the traversal tree of tree in part a). (4 points)
d) Give the definition of full binary tree and complete binary tree, and say the type of the tree in part a). (4 points)
e) The order in which a fixed set of elements are inserted into a binary search tree does not matter; the same tree results every time.
Is this expression correct? If yes, explain why. If not explain why not. (5 points)
f) Write the **method in java** to:

- add a node to a binary search tree (5 points)
- remove a node from a binary search tree (5 points)
- find the maximum depth of a Tree (5 points)

Question 4: Graph (21 points)



Graph 1



Graph 2

a) Step through Dijkstra's algorithm to calculate shortest paths from **S to every other vertex** in directed graph 1. Show your steps in a table. Cross out old values and write in new ones, from left to right within each cell, as the algorithm proceeds. (10 points)

b) Give the MST for graph 2 using Prim-Jarnik's algorithm from vertex 0, in form of adjacency list representation and adjacency matrix representation (11 points)

Good Luck!