



United International University (UIU)

Dept. of Computer Science & Engineering (CSE)

Final Exam Total Marks: **25** Fall-2020

Course Code: CSI 227

Course Title: Data Structure and Algorithms II

Time: 1 hour 15 minutes for answering. Another 15 minutes for download and upload

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.

1

a) Show the shortest-path tree for the following graph using Dijkstra's algorithm.

The tree you just obtained using Dijkstra's algorithm is not really the shortest-path tree. Can Bellman-Ford algorithm get the shortest-path tree for you here? Justify your answer with proper reasoning.

b) Consider an open-addressing hash table as shown below. The table already contains three data items, and other empty slots contain '#'. Assume that collisions are handled by the following hash function:

$$h(k, i) = (h(k) + i^2 * h'(k)) \bmod 11$$
, where $h'(k) = (k + 7) \bmod 11$ and $h(k) = k \bmod 11$.

By showing detailed calculations, redraw the table after the operations: (i) insert 121; (ii) insert 3; (iii) search 44

0	1	2	3	4	5	6	7	8	9	10
22	#		80	#	#		62	#	#	#

2

(a) Write an algorithm that prints the out-degree of each vertex for an adjacency matrix **Mat**. Analyse the running time of your algorithm.

(b) At the Rabin-Karp algorithm, for matching a pattern from a string of digits, why do we use the modulo operation? Show an example in which case the worst-case scenario occurs in the Rabin-Karp algorithm.

(c) "Sorting is an NP problem"- is the statement correct. Explain briefly.

[3+2]

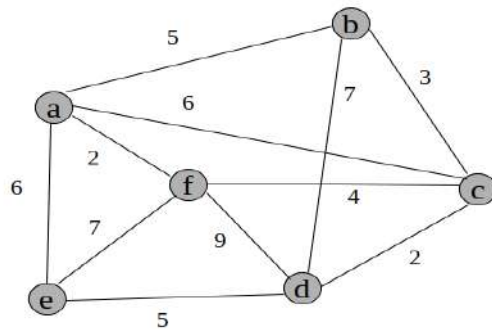
[3]

[3+1]

[1+2]

[2]

- 3 (a) Find a minimum spanning tree of the following graph using Kruskal's algorithm. [3]



- (b) Suppose, the edges of the above graph are sorted using bubble sort algorithm (The time complexity of bubble sort is $O(n^2)$). Is this going to affect the time complexity of the Kruskal's algorithm? Explain your answer briefly. [2]

- 4 Draw the resultant forest after calling UNION(6, 11) and after that, FIND-SET(9) on the disjoint-sets of the following figure. You must use the union-by-rank and the path-compression heuristics. [3]

