

Fall 2023 – CS 303 Algorithms and Data Structures
Lab 10

Notes:

- Implement the algorithm and analyze the results using the give input files
- Deliverables: Report.pdf file and your code file (**please do not send a zip file**. If you have more than one class in your code, then submit each file separately through Canvas.)
- Homework report must follow the guidelines provided in the sample report uploaded in Canvas

Objectives:

- Prim's Algorithm for minimum spanning trees.

Problems:

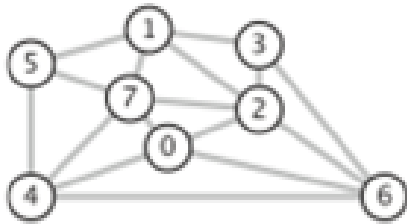
1. Implement a weighted graph class. Write a driver program, which reads input file mediumDG.txt (downloadable from Canvas) and display the weighted graphs by printing adjacency list.
2. Implement Prim's algorithm (provided below). Use your pre-lab assignment to check whether the output of your code is correct or not (tinyDG.txt).
3. Write a driver program, which reads input files mediumGraph.txt, LargeGraph.txt and XtraLargeGraph.txt (downloadable from Canvas) and run Prim's algorithm on each of them to find the minimum spanning tree within these graphs. Record the times required for each of these graphs and include this in your report.

NB: For the following pseudo code, you need to use a priority queue. You can use your own code from the heap sort assignment or use the appropriate Java or Python packages for the priority queue.

```
MST-PRIM( $G, w, r$ )
1  for each  $u \in G.V$ 
2       $u.key = \infty$ 
3       $u.\pi = \text{NIL}$ 
4   $r.key = 0$ 
5   $Q = G.V$ 
6  while  $Q \neq \emptyset$ 
7       $u = \text{EXTRACT-MIN}(Q)$ 
8      for each  $v \in G.Adj[u]$ 
9          if  $v \in Q$  and  $w(u, v) < v.key$ 
10              $v.\pi = u$ 
11              $v.key = w(u, v)$ 
```

Prelab Assignment

Consider the following edge-weighted graph with 8 vertices and 16 edges (input consists of $\{u,v,w(u,v)\}$). Compute the minimum spanning tree for this graph using Prim's algorithm and Kruskal's algorithm.



4/10/2019

4 5 0.35	0 2 0.26
4 7 0.37	1 2 0.36
5 7 0.28	1 3 0.29
0 7 0.16	2 7 0.34
1 5 0.32	6 2 0.40
0 4 0.38	3 6 0.52
2 3 0.17	6 0 0.58
1 7 0.19	6 4 0.93

DATA

largeDG.txt

mediumDG.txt

tinyDG.txt

XtraLargeDG.txt

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Grading Rubric

Coding	Implementing Algorithms	20 points
	Producing Correct Outputs	20 points
Report	Explaining the algorithms used	10 points
	Displaying the output with a graph or table	20 points
	Comparing the outputs and discussing the time complexity of algorithms	20 points
	Correct submissions of the files (ICF, Code.zip, report.pdf)	10 points