 Name and ID:
Signature:

BLG 336E ANALYSIS OF ALGORITHMS II
Midterm – March 29, 2016 (2 hours)

Q1 (20pt)	Q2 (30pt)	Q3 (25pt)	Q4 (25pt)	Total (100 pt)

On my honor, I declare that I neither give nor receive any unauthorized help on this exam.
Write your name on each page. Write your answers neatly (in English) in the space provided for them. You must show all your work for credit. Books and notes are closed. Good Luck!

Q1)[20pts] Consider the following job-shop scheduling problem. Each job is represented by its start time (s) and its finish time (f).

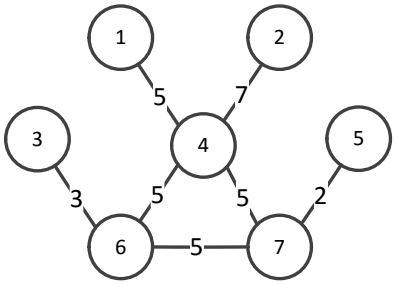
job	**s**	**f**
a	5	20
b	0	15
c	5	10
d	15	20
e	10	30

Q1a)[8pts] Give the pseudo code of a greedy scheduling algorithm that maximizes the total number of jobs processed when each job is processed by the same resource once at a time. Apply this algorithm and present the result.

Q1b)[4pts] What is the complexity of your algorithm? Why?

Q1c)[8pts] Give the pseudo code of a greedy scheduling algorithm that processes **all the jobs** with the minimum number of resources. Apply this algorithm and present the result indicating the corresponding resources of each job.

Q2) [30pts]



Q2a) [3pts] How many spanning trees does the given graph have? Explain concisely.

Q2b) [12pts] Use Kruskal's algorithm to find a minimum spanning tree for the given graph. List the edges in the order in which you consider them.

What is the algorithm's complexity?	

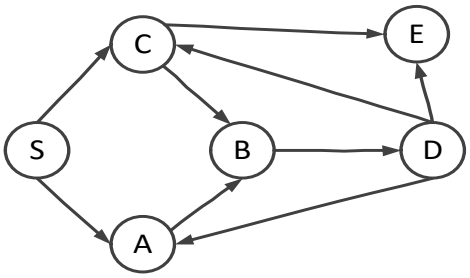
Q2c) [12pts] Use Prim's algorithm to find a minimum spanning tree for the given graph. List the edges in the order in which you consider them.

What is the algorithm's complexity?	

Q2d) [3pts] Do Prim's and Kruskal's algorithms always generate a unique minimum spanning tree? Please discuss in terms of both the structure of the graph and its cost.

Q3) [25 pts]

Q3a) [16 pts] Show the constructions of **BFS** (Breadth First Search) and **DFS** (Depth First Search) trees for the **directed graph** given below. Start from node S (root). Explain the exploration of each node step-by-step. Assign node generation number incrementally for each newly explored node, e.g., assign 0 to node S, 1 to the next one.

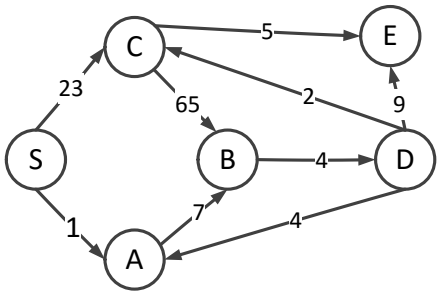


Q3b) [4 pts] Is the given graph connected? Why or why not? Explain in detail.

Q3c) [5 pts] Is the given graph strongly connected? Why or why not? Explain in detail.

Q4) [25 pts]

Q4a) [12 pts] Find the length of the shortest path from node S to node E in the graph below using Dijkstra's shortest path algorithm. Clearly indicate the variables you use and their states at each step of the algorithm.



Q4b) [8 pts] Suppose T is the shortest path tree of the graph given above. Assume that we add 5 to every edge in the graph, such as the new length of edge (S-A) = 1+ 5 = 6. After adding 5 to every edge, the new shortest paths tree is T_{new}. Are T and T_{new} the same? Explain why?

Q4c) [5 pts] List the vertices (nodes) in order in which they appear in the shortest path from S to E in the graph given above by using Dijkstra's algorithm. Use another list to show the new order of nodes after adding 5 to every edge of the graph. Calculate the distance of shortest path from S to E after adding 5 to every edge.