Homework 4: Dil Rawat

YSU

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1 [GT R-10.1]

Let $S = \{a, b, c, d, e, f, g\}$ be a collection of objects with benefit-weight values $a : (12, 4), b : (10, 6), c : (8, 5), d : (11, 7), e : (14, 3), f : (7, 1), g : (9, 6)$. What is an optimal solution to the fractional knapsack problem for S assuming we have a sack that can hold objects with total weight 18? Show your work.

Answer:

Answer goes here **Outcomes:** CS 2, CS 6, 5870-2

2 [GT R-10.3]

Suppose we are given a set of tasks specified by pairs of the start times and finish times as $T = \{(1,2),(1,3),(1,4),(2,5),(3,7),(4,9),(5,6),(6,8),(7,9)\}$. Solve the task scheduling problem for this set of tasks.

Answer:

Answer goes here **Outcomes:** CS 2, CS 6, 5870-2

3 [GT R-10.4]

Draw the frequency table and Huffman tree for the following string:
"dogs do not spot hot pots or cats".

Answer:

Answer goes here **Outcomes:** CS 2, CS 6, 5870-2

4 [GT C-10.4]

A native Australian named Anatjari wishes to cross a desert carrying only a single water bottle. He has a map that marks all the watering holes along the way. Assuming he can walk k miles on one bottle of water, design an efficient algorithm for determining where Anatjari should refill his bottle in order to make as few stops as possible. Argue why your algorithm is correct.

Answer:

Answer goes here **Outcomes:** CS 2, CS 6, 5870-2

5 [GT R-13.4]

Bob loves foreign languages and wants to plan his course schedule to take the following nine language courses: LA15, LA16, LA22, LA31, LA32, LA126, LA127, LA141 and LA169. The course prerequisites are:

- LA15: (none)
- LA16: LA15
- LA22: (none)
- LA31: LA15
- LA32: LA16, LA31
- LA126: LA22, LA32
- LA127: LA16
- LA141: LA22, LA16
- LA169: LA32

Find a sequence of courses that allows Bob to satisfy all the prerequisites. Show your work.

Answer:

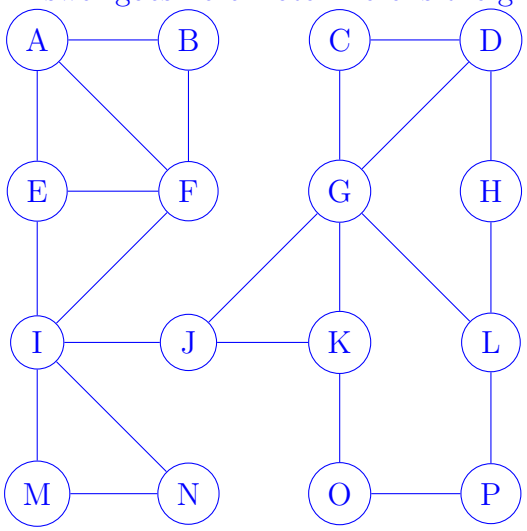
Answer goes here **Outcomes:** CS 2, CS 6, 5870-2

6 [GT R-13.15 (modified)]

How many biconnected components would be in the graph shown in Figure 13.5a if we were to remove the edge (B, C) and the edge (N, K)? List the edges in each biconnected component.

Answer:

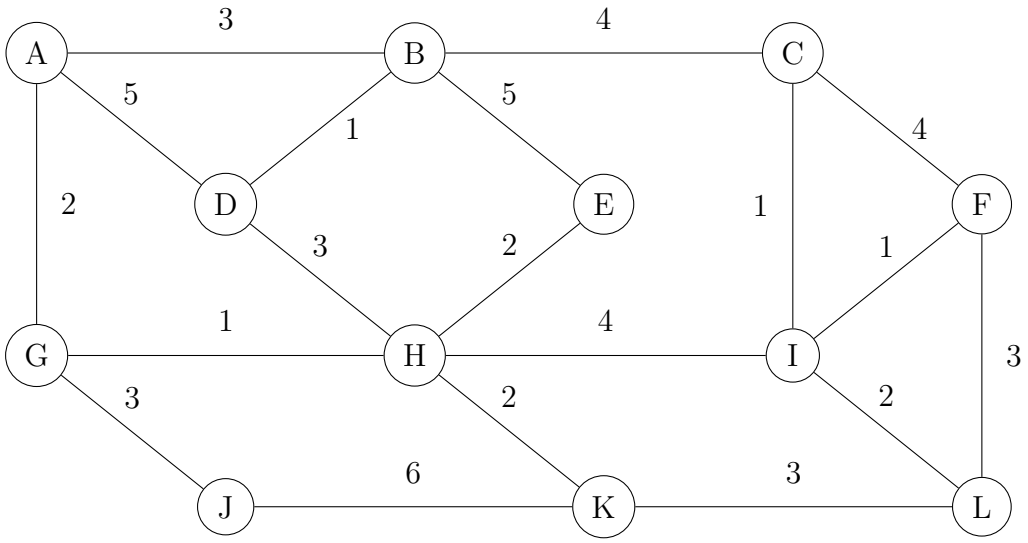
Answer goes here Note: Here is the graph with the two edges removed:



Outcomes: CS 2, CS 6, 5870-2

7 [Not in a book]

Given the following graph, use Kruskal's algorithm to construct a minimum-cost spanning tree. Indicate which edges are included and the order in which they are added. When sorting, break ties based on the order in which the edges appear in the LaTeX source code.



Answer:

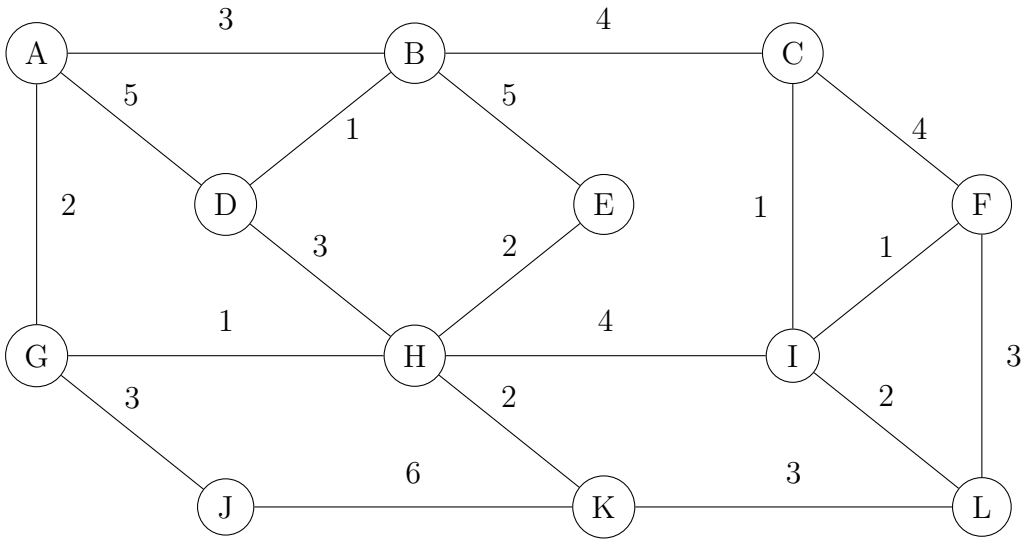
This is what the answer should look like. Note that this is not part of a correct answer.

Edge	Cost	Used
BC	1	Yes
CE	1	Yes
FI	1	Yes
HJ	1	Yes
DE	2	Yes
AB	3	Yes
AF	3	No

Outcomes: CS 2, CS 6, 5870-2

8 [Not in a book]

Given the following graph, use Prim's algorithm to construct a minimum-cost spanning tree. Indicate the order in which vertices are selected, and the cost of each selected vertex. After each selection / update, show the cost and parent of each unselected vertex. Assume all edge lists are processed in alphabetic order.



Answer:

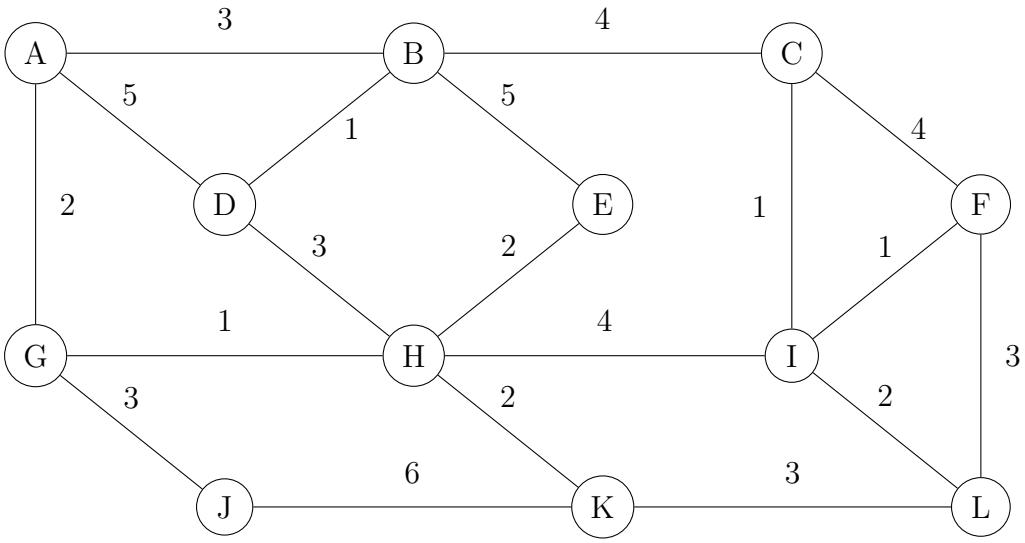
This is what the answer should look like. Note that this is part of a correct answer.

A	B	C	D	E	F	G	H	I	J	K	L
A/-/0	B/A/3	C/-/-	D/A/5	E/-/-	F/-/-	G/A/2	H/-/-	I/-/-	J/-/-	K/-/-	L/-/-
	B/A/3	C/-/-	D/A/5	E/-/-	F/-/-	G/A/2	H/G/1	I/-/-	J/G/3	K/-/-	L/-/-

Outcomes: CS 2, CS 6, 5870-2

9 [Not in a book]

Given the following graph, use Dijkstra's algorithm to find shortest paths from vertex A to all other vertices. Indicate the order in which vertices are selected, and the cost of each selected vertex. After each selection / update, show the cost and parent of each unselected vertex. Assume all edge lists are processed in alphabetic order.



Answer:

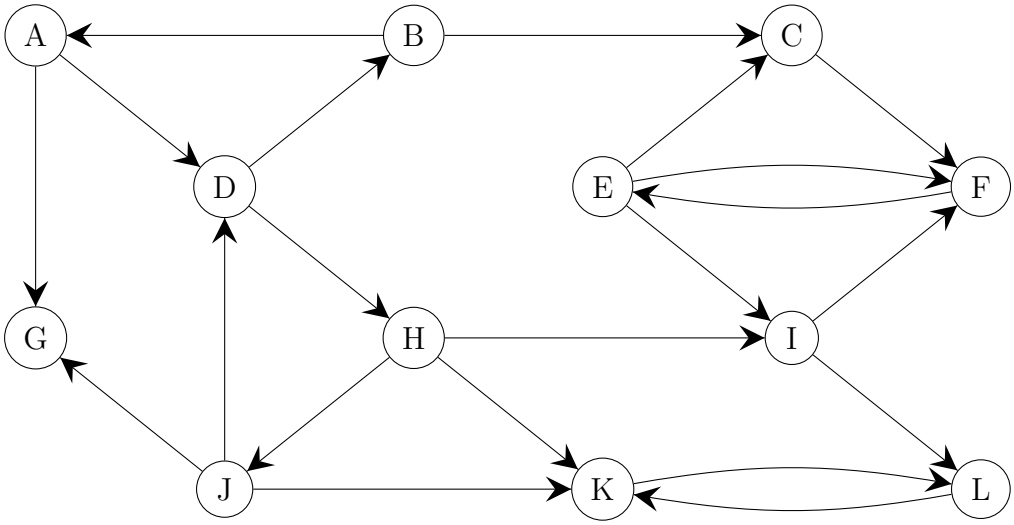
This is what the answer should look like. Note that this is not part of a correct answer.

A	B	C	D	E	F	G	H	I	J	K	L
A/-/0	B/A/3	C/-/-	D/A/5	E/-/-	F/-/-	G/A/2	H/-/-	I/-/-	J/-/-	K/-/-	L/-/-
	B/A/3	C/-/-	D/A/5	E/-/-	F/-/-	G/A/2	H/G/1	I/-/-	J/G/3	K/-/-	L/-/-

Outcomes: CS 2, CS 6, 5870-2

10 [Not in a book]

Given the following graph, find and show the strongly-connected components. Show the stack created after the first DFS. Assume that all vertex lists are processed in alphabetical order.



Answer:

Answer goes here **Outcomes:** CS 2, CS 6, 5870-2

11 [GT C-13.6]

Let G be an undirected graph whose vertices are the integers 1 through 8, and let the adjacent vertices of each vertex be given by the table below:

vertex	adjacent vertices
1	$(2, 3, 4)$
2	$(1, 3, 4)$
3	$(1, 2, 4)$
4	$(1, 2, 3, 6)$
5	$(6, 7, 8)$
6	$(4, 5, 7)$
7	$(5, 6, 8)$
8	$(5, 7)$

Assume that, in a traversal of G, the adjacent vertices of a given vertex are returned in the same order as they are listed in the above table.

a Draw G.

b Order the vertices as they are visited in a DFS traversal starting at vertex 1.

c Order the vertices as they are visited in a BFS traversal starting at vertex 1.

Answer:

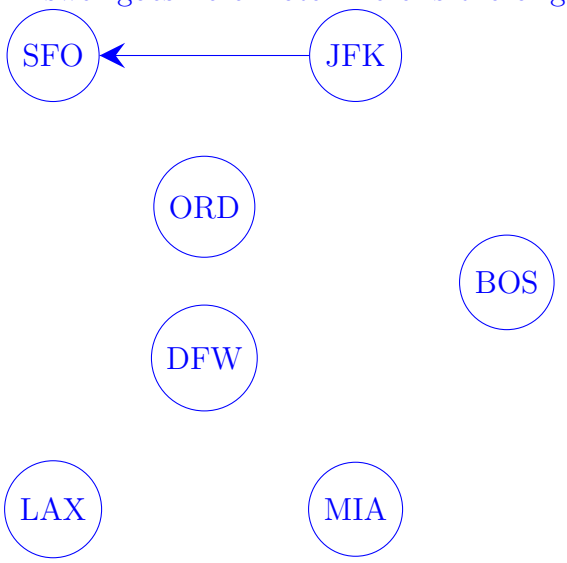
Answer goes here **Outcomes:** CS 2, CS 6, 5870-2

12 [GT R-13.9 (modified)]

List the edges added while computing the transitive closure of the directed graph shown in Figure 13.2.

Answer:

Answer goes here Note: Here is the original graph, without the edge labels for clarity.



Outcomes: CS 2, CS 6, 5870-2