Final Exam Section 1 Spring 2017, Part B
Computer Science Department, SJSU CS146: Data Structures and Algorithms
Instructor: Katerina Potika

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Section	Points
Question 1	_____Out of 24
Question 2	_____Out of 14
Question 3	_____Out of 14
Question 4	_____Out of 20
Total	_____Out of 72

Duration 1h. Closed Books. Good luck!

Question 1 - What is your name again?
Name the three techniques we presented in our class. Give an example of an algorithm for each technique and what problem it solves. [2pts/each entry: total 18pts]

	Name of Technique	Algorithm	Problem
1			
2			
3			

Compare each one to the other two by giving one similarity or one difference. [6pts]
1-2:

1-3:

2-3

Question 2 - Can you save?

(14pts) You have a startup with several offices as shown in the next graph; you want to lease phone lines to connect them up with each other. The phone company charges different amounts of money to connect different pairs of offices (weight on edges). You want a set of lines that connects all your offices with minimum total cost.

- I. (2pts) What are you trying to compute?
- II. (2pts) Name the algorithm you will use.
- III. (10pts) Give the order in which you select edges (endpoints) inside the next table, the total money (cost) you have to spend. If the algorithm you use needs a starting vertex, start it on vertex s.
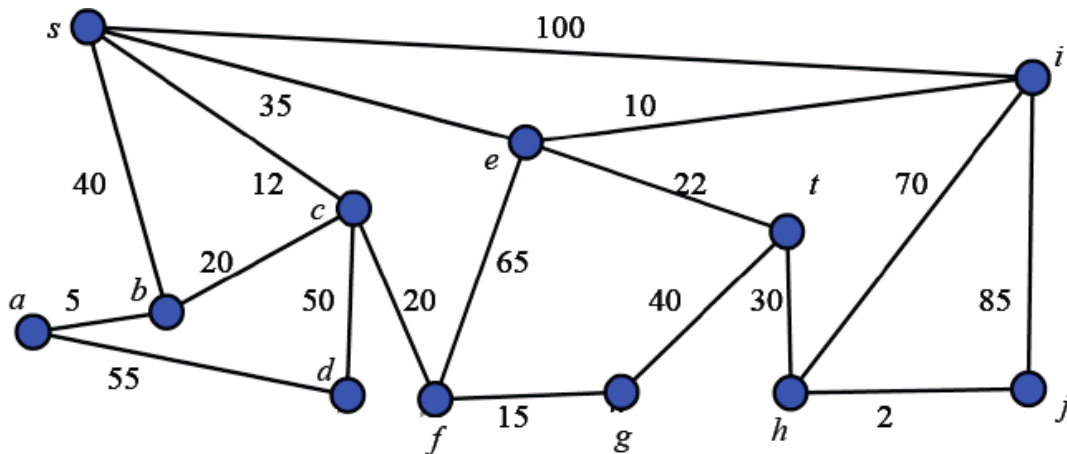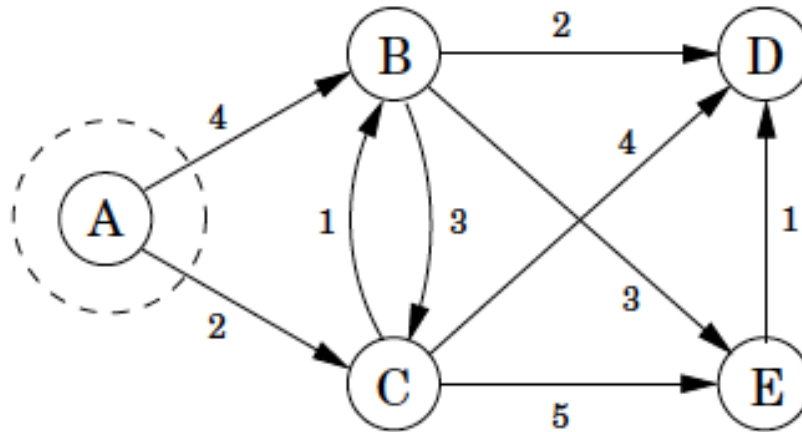

Solution:

Question 3- Pathfinder-edis

(14pts) You are designing a video game in your start up, where you have cities and roads connecting them (see given graph, weight is the distance between cities). You want to use a "Pathfinding" method to plot route from city A to all other city.

a. (2pts) What problem are you trying to solve?

b. (2pts) What is a good algorithm?

c. (10pts) Fill the next table to find the routes

Solution:

Set	A	B	C	D	E

Question 4 – Mars here we come

(20 pts) You are part of Mars One that aims to establish a permanent human settlement on Mars. Several unmanned missions will be completed, establishing a habitable settlement before carefully selected and trained crews will depart to Mars. In one of them you have a spaceship of capacity W and some items with weight and possible benefit to the settlement. You have to decide which items fit in the spaceship and maximize the total benefit. The items have this nice property that the order of the items when sorted by increasing weight is the same as their order when sorted by decreasing value. Give an efficient algorithm to find an optimal solution and argue that your algorithm is optimal. Name the technique you used and compute the running time of your algorithm?

Let $i_1, i_{2,} \ldots, i_n$ be the items with benefit $b_1, b_2, \ldots, b_n$ and weight $w_1, w_2, \ldots, w_n$.

Fact: $w_1 \leq w_2 \leq .. \leq w_n$ and $b_1 \geq b_2 \geq \cdots \geq b_n$

Solution: