CS 4520-6520 Test #3

Goli Harsha

TOTAL POINTS

77 / 115

QUESTION 1

1 Dijkstra's algorithm 15 / 15

✓ **- 0 pts Correct**

- 15 pts Wrong/Not answered

QUESTION 2

2 Bellman-Ford 15 / 15

✓ **- 0 pts Correct**

- 15 pts Wrong/Not answered

QUESTION 3

Floyd-Warshall 20 pts

3.1 Floyd-Warshall 12 / 15

- 0 pts Correct

✓ **- 15 pts Wrong/Not answered**

+ 12 Point adjustment

You haven't done all the v^3 (4^3 = 64) iterations.
Eg: One of the case you have missed is: [3][2] > [3][4] + [4][2] (3 > -4-1 => 3>-5)
D4:
0 2 8 6
3 0 10 8
-7 -5 0 -1
-5 -4 2 0

3.2 EC 0 / 5

- 0 pts Correct

- 2.5 pts Some explanations

✓ **- 5 pts No answer/incorrect**

How exactly you figured it out? We need quantitative parameter.

QUESTION 4

4 Ford-Fulkerson 14 / 15

- 0 pts Correct

✓ **- 15 pts Wrong/Not attempted**

+ 14 Point adjustment

Max flow is 40. You have got 40 <= 20 (from s->1->3->5->t)+10(s->2->3->5->->t)+10(s->2->4->6->t). Why did you write 20?

QUESTION 5

NP class 16 pts

5.1 Optimization formulation 0 / 4

- 0 pts Correct

✓ **- 4 pts Incorrect/not attempted**

5.2 Decision formulation 0 / 4

- 0 pts Correct

- 1 pts No parameter

✓ **- 4 pts No answer/icorrect**

5.3 size certificate 0 / 4

- 0 pts Correct

- 2 pts Not clear answer

✓ **- 4 pts Incorrect/no answer**

5.4 Polynomial time verification 0 / 4

- 0 pts Correct

- 2 pts No algorithm provided

✓ **- 4 pts Incorrect/no answer**

QUESTION 6

6 3-CNF 12 / 15

✓ **- 0 pts Correct**

- 9 pts Check the comments

- 15 pts Wrong/Not attempted

- 3 Point adjustment

Max Independent set not marked.

QUESTION 7

7 Max Independent set/Min vertex cover/Max Clique 9 / 9

✓ **- 0 pts** **Correct**

- 3 pts One is incorrect

- 6 pts Two are incorrect

- 9 pts Wrong/Not answered

QUESTION 8

8 EC 0 / 10

- 0 pts Correct

- 5 pts Partial explanations

✓ **- 10 pts** **Npt attempted/incorrect**

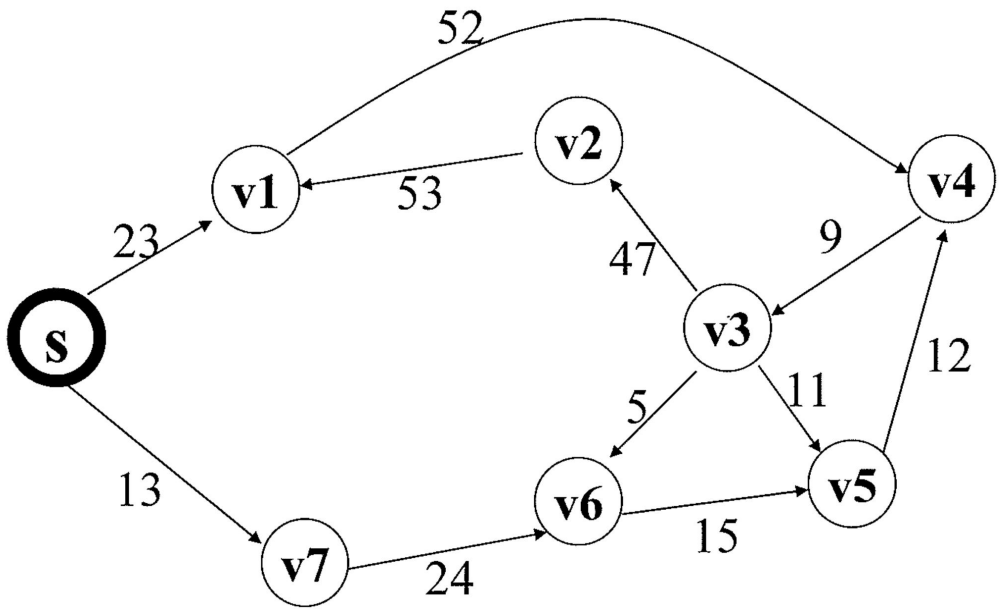
Spring 2018

TEST 3

4520

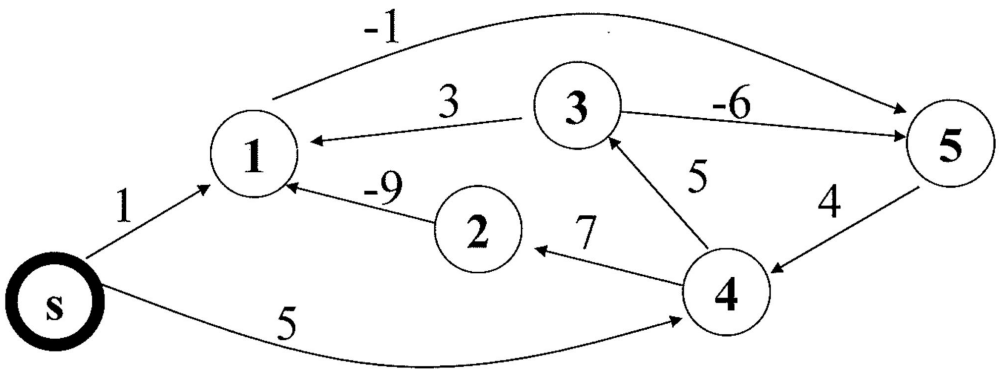
LAST NAME: Goli FIRST NAME: Harshu

#1. Run Dijkstra algorithm for the graph G below, with source s (weights are on edges).



	s	v1	v2	v3	v4	v5	v6	v7
Length of path:	0	23	120	73	~~75~~ 61	52	37	13
Found from vertex:		s	v3	v4	~~v1~~ v5	v6	v7	s

#2. Run Bellman-Ford on the graph below with starting vertex s.
You can draw and cross-out values in the table below as you go. Make sure final values are your answer.



	s	v1	v2	v3	v4	v5
Length of path:	0	1	~~12~~ 11	~~10~~ 9	~~5~~ 4	0
Found from vertex:		s	v4	v4	~~s~~ v5	v1

K = 1 2 3 4

i = 1 2 3 4

j = 1 2 3 4

$d[i][j] > d[i][k] + d[k][j]$

$[1][1] > [1][1] + [1][1]$

$0 > 0 + 0$

	1	2	3	4
1	0	11	8	6
2	2	0	10	8
3	-7	3	0	-1
4	-5	-4	2	0

$[1][2] > [1][1] + [1][2]$

$11 > 0 + 11$

$[1][3] > [1][1] + [1][3]$

$\infty > 0 + \infty$

$[2][1] > [2][2] + [2][1]$

$\infty > 0 + \infty$

$[3][1] > [3][2] + [2][1]$

$-7 > \infty + \infty$

$[3][2] > [3][1] + [1][2]$

$3 > -7 + 11$

✓ $[3][4] > [3][1] + [1][4]$

$12 > -7 + 6$

$[4][2] > [4][1] + [1][2]$

$4 > \infty + 11$

$[1][1] > [1][2] + [2][1]$

$0 > 11 + \infty$

$[1][2] > [1][2] + [2][2]$

$11 > 11 + 0$

$[1][3] > [1][2] + [2][3]$

$\infty > 11 + \infty$

$[1][4] > [1][2] + [2][4]$

$6 > 11 + 8$

$[2][1] > [2][2] + [2][1]$

$\infty > 0 + \infty$

$[3][1] > [3][2] + [2][1]$

$-7 > 3 + \infty$

$[3][2] > [3][2] + [2][2]$

$3 > 3 + 0$

$[3][3] > [3][2] + [2][3]$

$0 > 3 + \infty$

$[3][4] > [3][2] + [2][4]$

$-1 > 3 + 8$

$[4][1] > [4][2] + [2][1]$

$\infty > -4 + \infty$

$[4][2] > [4][2] + [2][2]$

$-4 > -4 + 0$

$[4][3] > [4][2] + [2][3]$

$2 > -4 + \infty$

$[4][4] > [4][2] + [2][4]$

$0 > -4 + 8$

$[1][1] > [1][3] + [3][1]$

$0 > \infty + -7$

$[1][2] > [1][3] + [3][2]$

$11 > \infty + 3$

$[2][1] > [2][3] + [3][1]$

$\infty > \infty + -7$

$[3][1] > [3][3] + [3][1]$

$-7 > 0 + -7$

✓ $[4][1] > [4][2] + [2][1]$

$\infty > 2 + -7$

$[4][2] > [4][3] + [3][2]$

$-4 > 2 + 3$

$[4][4] > [4][3] + [3][4]$

-1

$[1][1] > [1][4] + [4][1]$

$0 > 6 + -5$

✓ $[1][2] > [1][4] + [4][2]$

$\infty > 6 + -4$

✓ $[1][3] > [1][4] + [4][3]$

$\infty > 6 + 2$

$[1][4] > [1][4] + [4][4]$

$6 > 6 + 0$

$[2][1] > [2][4] + [4][1]$

$2 > 8 + -5$

$[2][2] > [2][4] + [4][2]$

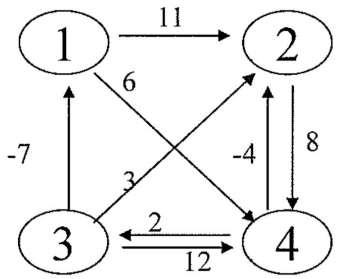
$0 > 8 + -4$

✓ $[2][3] > [2][1] + [4][3]$

$\infty > 8 + 2$

#3. Find all shortest path weights with the Floyd-Warshall method for the graph on the right side.

- give all matrices that are obtained on the way
- CIRCLE changes.



$D^0 =$

source \ destination	1	2	3	4
1	0	11		6
2		0		8
3	-7	3	0	12
4		-4	2	0

$D^1 =$

0				
	0			
		0		
			0	

$D^2 =$

0				
	0			
		0		
			0	

$D^3 =$

0				
	0			
		0		
			0	

$D^4 =$

0	11	8	6	-23
2	0	10	8	-20
-7	3	0	-1	-5
-5	-4	2	0	-7
-10	-18	-23	-13	

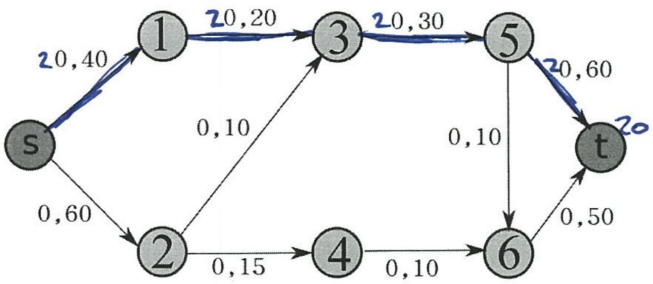
Work shown on back of other page.

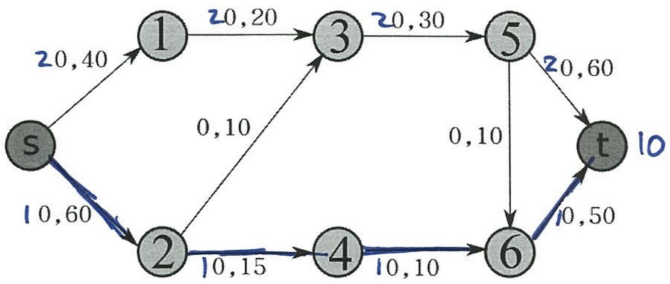
EC. Give reasoning at which "city" (=vertex) it would make most sense to build a hospital and why. Is your answer dependent on whether we are interested in incoming traffic (e.g. how fast patient can reach the hospital) or outgoing (e.g. how far ER vehicle can reach the patient)? If so, how?

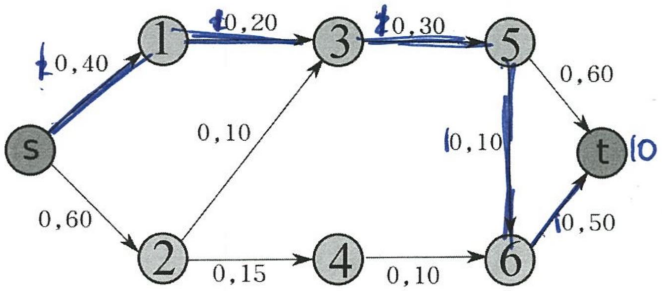
City 4. Not to difficult to get to (rank 3/4), Not difficult to leave from (2/4). All other cities highly favor either leaving or going but City 4 moderately favors both.

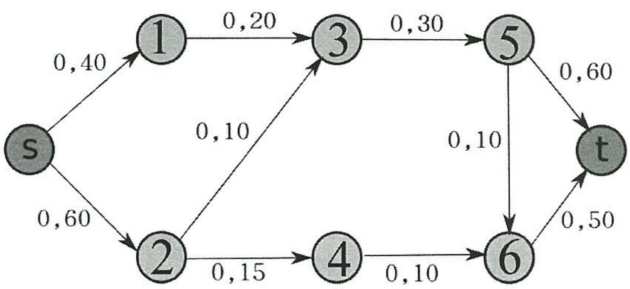
#4. Run Ford-Fulkerson algorithm for the following network.

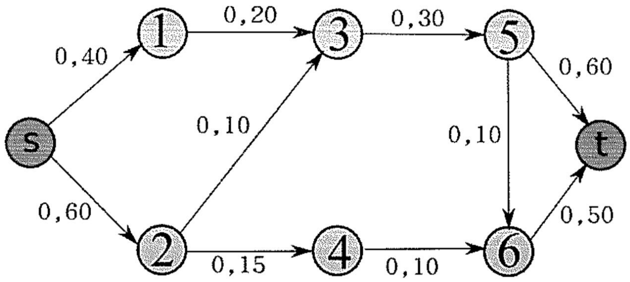
Note that starting drawing already has a zero flow (first label on edges). Second label on edge indicates edge capacity. So, find a maximum flow from source s to sink t in this network. You can choose to draw residual network if you wish or just use existing one and change it. For your convenience I copied same network several times – show changes as you go. In the end, indicate MAX FLOW (total flow) through your network: 20










s
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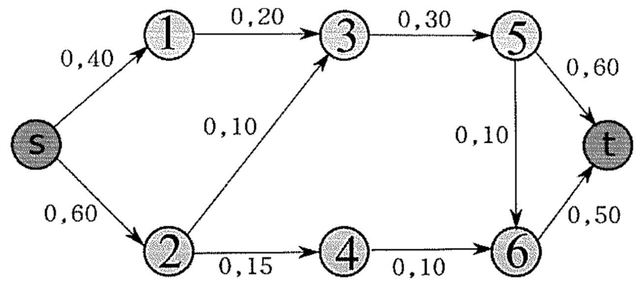
0,60
0,50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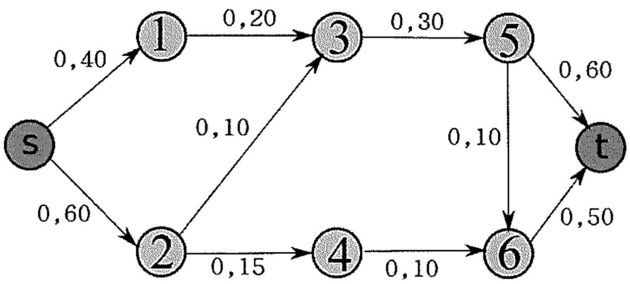
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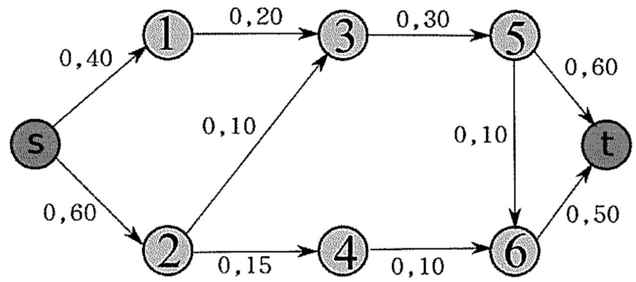
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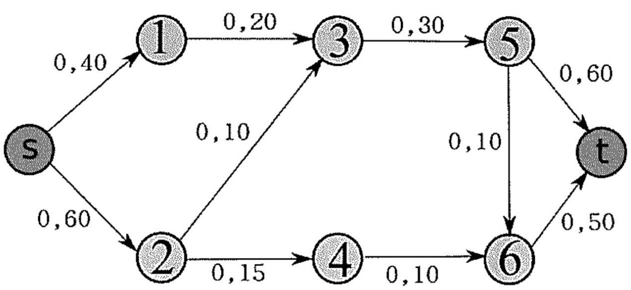
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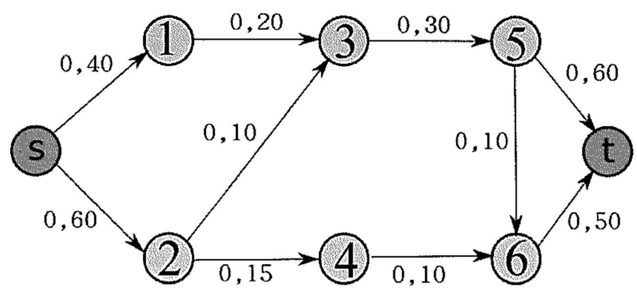
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0,50

#5. Prove, that the Max Independent Set (finding set of vertices in a graph, no two of which are adjacent) is in class NP

a) Optimization formulation

b) Decision formulation (yes/no)

c) Polynomial-size certificate ("hint")

d) Polynomial time verification algorithm (estimate its running time)

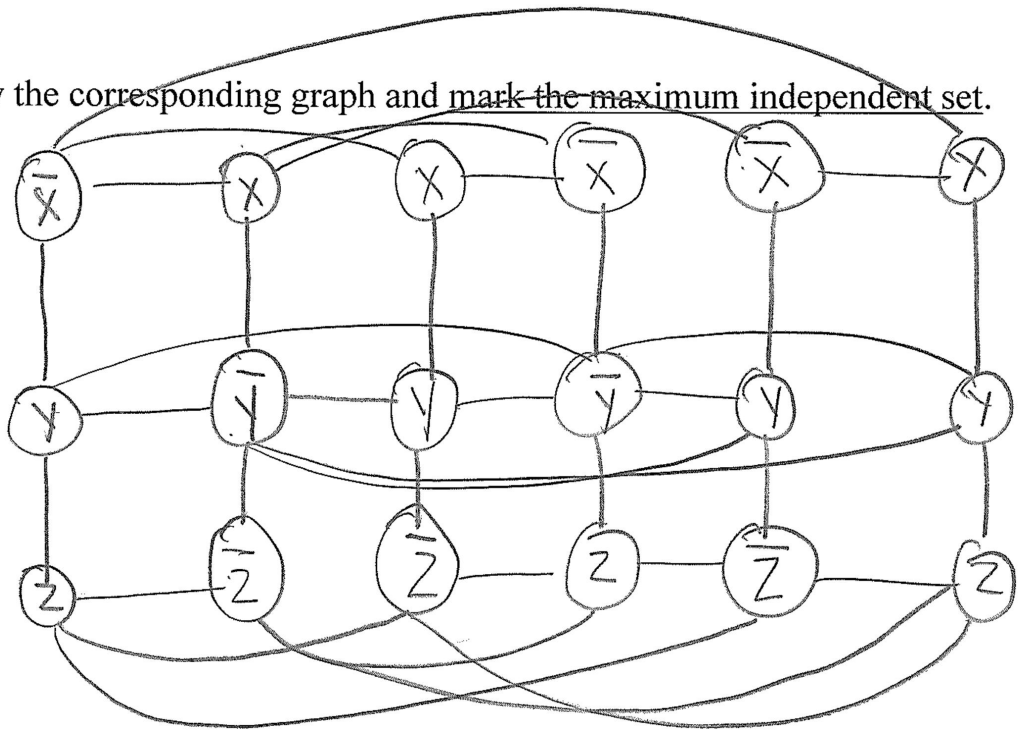
#6. For the 3-CNF

f = (x' +y+z)& (x+y'+z')&(x+y+z')& (x'+y'+z)&(x'+y+z') &(x+y+z)

give 0-1 assignment to variables such that f=1. x= 0 y= 1 z= 0

give 0-1 assignment to variables such that f=0 . x= 0 y= 0 z= 0

-Draw the corresponding graph and ~~mark the maximum~~ independent set.

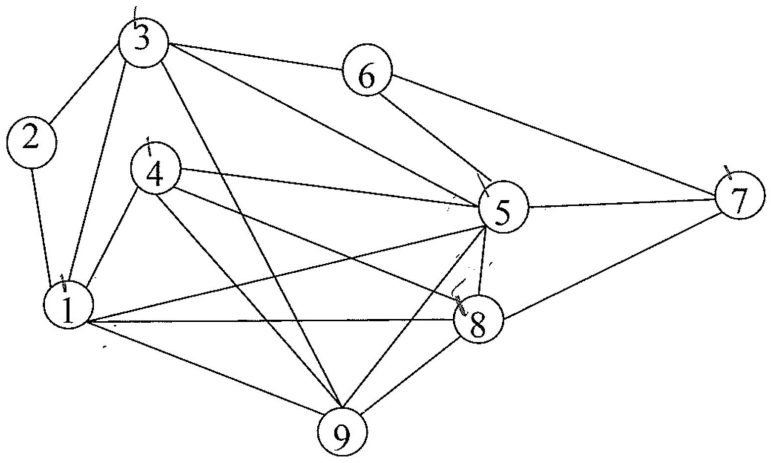


#7.

In the following graph find (if several of same size exists – write just one)

- Maximum Independent Set 2, 6, 9
- Minimum Vertex Cover 1, 3, 4, 5, 7, 8
- Maximum Clique 1, 4, 5, 8, 9

20



7. $x \geq 20$

7. $\frac{3}{} \geq 20$

- EC.

Albert and Bernard just became friends with Cheryl, and they want to know when her birthday is. Cheryl gives them both a list of 10 possible dates:

May		15	16			19
June				17	18	
July	14		16			
August	14	15		17		

Cheryl then tells Albert the month (only month) and Bernard the day (only day) of her birthday.

Albert: -I don't know when Cheryl's birthday is, but I know that Bernard doesn't know too.
Bernard: -At first I didn't know when Cheryl's birthday is, but I know now.
Albert: -Then I also know when Cheryl's birthday is.

- So when is Cheryl's birthday? _____
- How you figured it out?