Department of
Industrial Engineering

IE 454 Combinatorial Analysis

http://ie454.cankaya.edu.tr
Spring 2010 Tuesday 9:40-12:30 A201
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FINAL EXAM

1 page 2 sides self hand-written cheat sheet is allowed!
4.6.2010 - 17:00

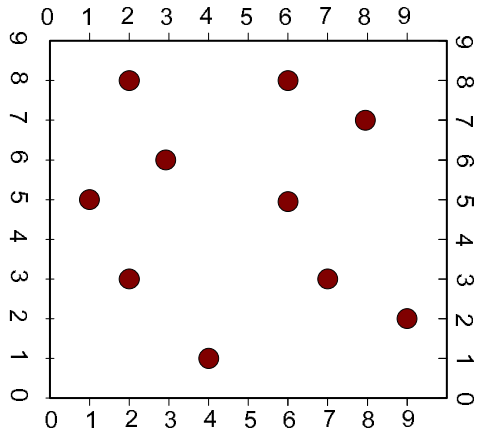
I hereby declare that I have neither given nor received any aid during the final exam.
☐ *I accept* ☐ *I decline* *Signature:*

Name: _____
Surname: _____
Number: _____

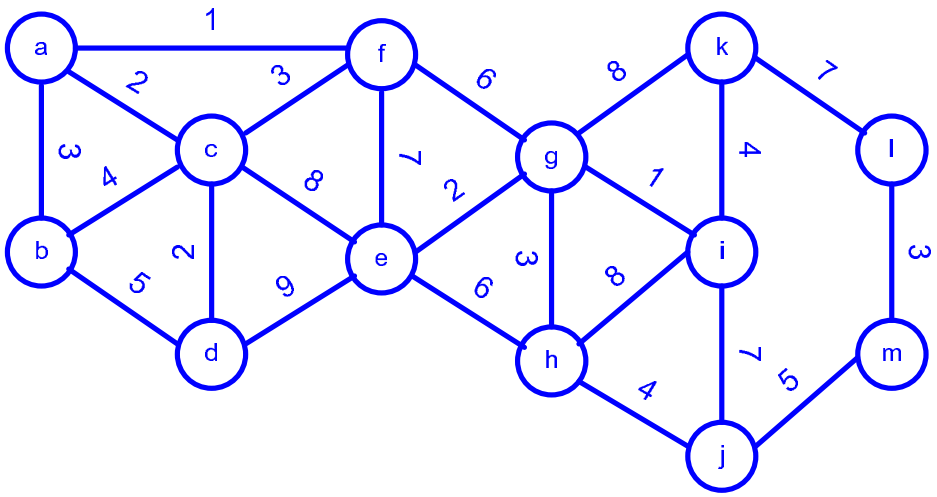
Question	Time	Points	Obtained
Q1	25	80	
Q2	15	80	
Q3	35	100	
Q4	35	90	
TOTAL	110	350	

GOOD LUCK!

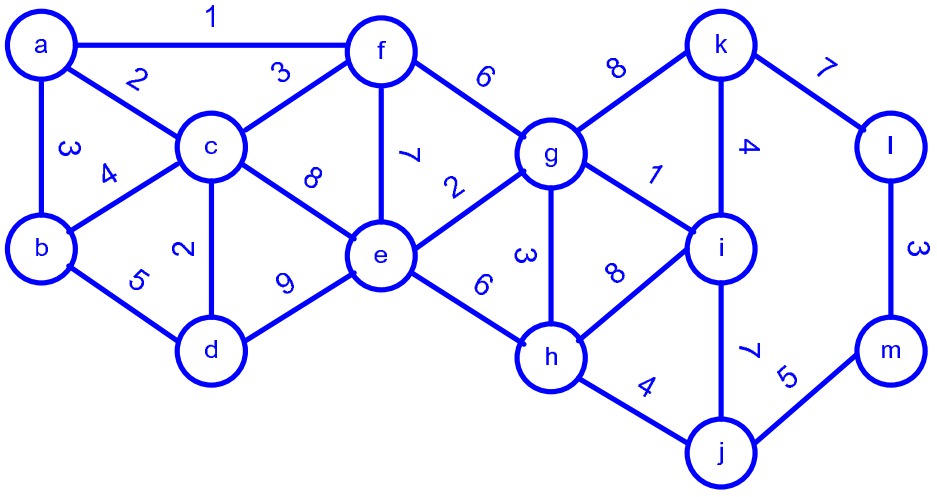
Q1. Apply the band heuristic with 4 vertical strips for finding an initial TSP tour of the • points to be visited. Show the tour in the figure. Calculate the tour length in terms of Rectilinear Distance. Calculate the gain of deleting the edge between (9,2)–(2,3) and the edge between (4,1)–(7,3). What is your decision for this swap? Why? [80pt]



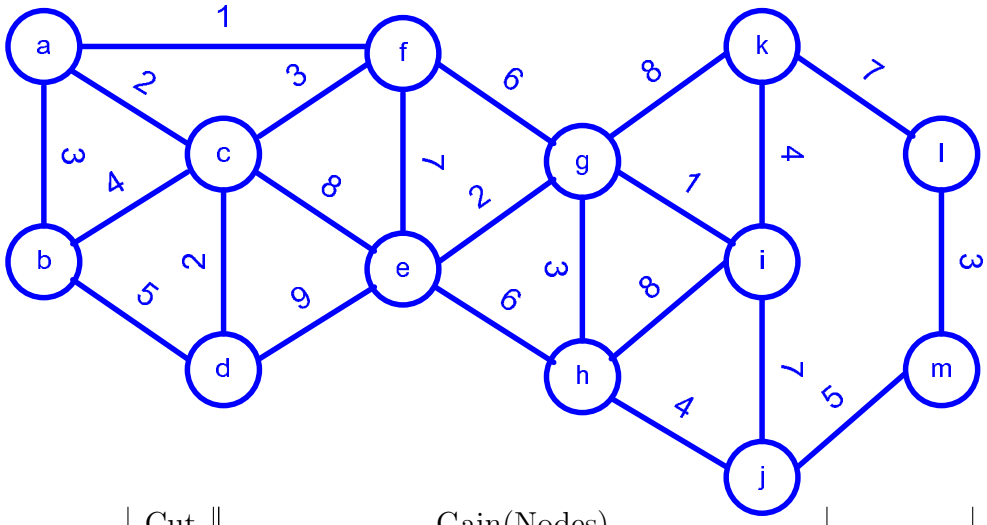
Q2.[40pt] Find the minumum spanning tree and the associated cost(length).



[40pt]Find a solution for the Steiner tree problem and the associated cost(length) where the selected set is $R = \{a, d, g, m\}$.



Q3. Apply the nongreedy method with threshold equal to 3 for finding the maximum cut (total weight of the edges in the cut defined by $S \subseteq \{a, b, c, d, e, f, g, h, i, j, k, l, m\}$) problem for the following graph. Once you have moved a node, freeze it. Let the initial set be $S = \{c, h, k\}$. Break the ties by selecting the node with the minimum lexicographical order. Report the best greedy and nongreedy solutions. [100pt]



Iter #	S =?	Cut Size	Gain(Nodes) a	b	c	d	e	f	g	h	i	j	k	l	m	Decision	New cut size
1	{ }																
2	{ }																
3	{ }																
4	{ }																
5	{ }																
6	{ }																
7	{ }																
8	{ }																
9	{ }																
10	{ }																
11	{ }																
12	{ }																
13	{ }																

Greedy Solution: Max-cut Value:

Nongreedy Solution: Max-cut Value:

Q4. Use dynamic programming to solve the following knapsack problem. Four categories of jobs are available, with quantities, times, and values shown in the table. We have 9 days available.

Job	Possible #	Time per job	Value per job
1	4	1	3
2	2	4	15
3	3	2	8
4	3	3	12

d_n: # jobs in category n selected,

x_n: # days remaining when we reach n.

Transformation functions:[5pt]
$x_3 = t_4(x_4, d_4) =?$
$x_2 = t_3(x_3, d_3) =?$
$x_1 = t_2(x_2, d_2) =?$
$x_0 = t_1(x_1, d_1) =?$

Return functions:[5pt]
$r_4(x_4, d_4) =?$
$r_3(x_3, d_3) =?$
$r_2(x_2, d_2) =?$
$r_1(x_1, d_1) =?$

Stage 1:[10pt]

x_1	d_1^*	$f_1(x_1)$
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		

Stage 2:[15pt]

d_2:	$r_2(x_2, d_2) + f_1(x_1)$							
x_2	0	1	2	3	4	d_2^*	$f_2{}^*$	x_1
0								
1								
2								
3								
4								
5								
6								
7								
8								
9								

Stage 3: [15pt]

d_3:	$r_3(x_3, d_3) + f_2(x_2)$							
x_3	0	1	2	3	4	d_3^*	f_3*	x_2
0								
1								
2								
3								
4								
5								
6								
7								
8								
9								

Stage 4:[10pt]

d_4:	$r_4(x_4, d_4) + f_3(x_3)$							
x_4	0	1	2	3	4	d_4^*	f_4*	x_3
9								

OPTIMUM SOLUTION (in box notation please): [10pt]

What if we have 8 days available? Please answer in box notation and indicate the total cost.

Stage 4: [10pt]

d_4:	$r_4(x_4, d_4) + f_3(x_3)$							
x_4	0	1	2	3	4	d_4^*	f_4*	x_3
8								

Box Notation: [10pt]