

IE102 Spring 2018 Homework I - Due: March 12, Monday 17:00

IMPORTANT: READ BEFORE YOU START WORKING ON THE HOMEWORK

Information on Homework I

- Homework I is 3%. Make sure that you review course material before you start. Cite sources used if any.
- Homework assignment will be conducted in groups of 2. We randomly form the groups. You can find your group member and his/her contact information at the course website. **If you cannot reach your group member by all means, indicate this on the cover page of your submission.**
- Grading Policy: The homework grades will not be only based on the correctness of the answers provided, but on the perceived degree of effort on the returned assignment. There exists no motive for the students to copy the answers from someone else, since even without obtaining the correct answers one can obtain full credit. The grading scale for each question is 2 points (full effort), 1 point (some effort), and 0 (no effort or no submission).
- Academic Dishonesty (taken from IE102 Course Information): **Academic misconduct is not tolerated, and violations will be treated in accordance with the university policy.** For assignments: Discussion of the course material and working in groups are effective ways of learning. However, this does not mean that you can copy the assignment from one of your friends. You can discuss with your friends, but you should be alone, without any written solution in front of you, when you actually prepare your assignment. It is extremely important to understand the value of this exercise in the process of learning. Any violation of the above understanding will result measures outlined in the student rules and regulations.
- Submission Information: An assignment submission box will be placed in front of office EA327 on the morning of the submission date and will be removed at the time of the deadline. You need to put your assignment in the designated box before the submission deadline. **Submission via e-mail is NOT accepted.**
- Question 4 will be covered in March 6-8, Tuesday-Wednesday-Thursday Lecture.

Contact TA Gül Çulhan if you have questions related to this HW: gul.culhan@bilkent.edu.tr

There will be an office hour prior to the submission deadline.

Question 1:

Suppose that a problem with decision variables x and y consists of the following objective function and constraints:

$$\begin{aligned}
 &\text{maximize} && 5x-3y \\
 &\text{subject to} && 2x + y \leq 10 \\
 &&& x - 3y \geq 3 \\
 &&& 5x - 4y \geq 0 \\
 &&& x, y \geq 0
 \end{aligned}$$

- a) Draw the feasible region.
- b) Solve the problem graphically. What is the optimum solution and optimum solution value?

Question 2:

Suppose your old laptop does not satisfy the needs of you and you decided to buy a new laptop. In choosing which laptop to buy, you may consider the following criteria: (1) Price, (2) RAM, (3) Storage, (4) Battery life. The table below presents the scale range and type used for each measure and data for each laptop respectively.

<u>Measure</u>	<u>Range</u>
Price	4000-6000 TL
RAM	8-16 GB
Storage	512 GB – 2 TB
Battery life	1. Good 2. Average 3. Bad

<u>Measure</u>	<u>Laptop 1</u>	<u>Laptop 2</u>	<u>Laptop 3</u>
Price	4300	5250	5900
RAM	12	16	8
Storage	512 GB	1 TB	2 TB
Battery Life	2	3	1

Which computer will you buy by utilizing given information? Find out using MCDM methods that you learnt in class. (Assess your own weights for each measure).

Question 3:

Consider the activities, their predecessors and completion durations given below:

<u>Activity</u>	<u>Immediate Predecessors</u>	<u>Estimated Duration</u>
A	-	2 days
B	A	3 days
C	A	5 days
D	A	1 day
E	D	7 days
F	B, C	2 days
G	C	6 days
H	E, F, G	3 days
I	E	10 days
J	I	2 days
K	H	2 days
L	J, K	5 days
M	I	1 day
N	L, M	2 days

- a) Draw the AON (Activity on Node) network.
- b) Perform the critical path activities (i.e., calculate Earliest start (ES), Earliest finish(EF), Latest start(LS) and Latest finish(LF) for each activity).
- c) After computing the ES, EF, LS, and LF times for all activities, compute the slack or free time for each activity.
- d) Decide the critical path and state the completion time of entire project.

(Material to be covered 6-8 March)

Question 4:

A manufacturer of wheels for tractor (TRACT) has a plant located in Manisa. It sells its products throughout six cities: İzmir, Ankara, Edirne, Gaziantep, Samsun and Adana. TRACT is working contract based and therefore knows how many customers it should serve at each of these 6 cities. This information is given below:

	İzmir	Ankara	Edirne	Gaziantep	Samsun	Adana
Number of Customers	100	115	105	120	130	90
Distance from Manisa	35	563	539	1096	976	884

The company has enough budget to open two new plants if it shuts down the leased Manisa factory. The candidate locations for these new factories are: Kocaeli, İstanbul, Afyon, Erzurum and Sinop. The distance matrix of these new locations and the set of customer locations are as follows:

	İzmir	Ankara	Edirne	Gaziantep	Samsun	Adana
Kocaeli	453	342	341	1009	623	828
İstanbul	564	453	230	1120	734	939
Afyon	327	256	684	785	669	573
Erzurum	1454	875	1458	637	561	806
Sinop	991	412	912	854	155	846

- Calculate TRACT's total weighted distance for the current case (The factory is at Manisa).
- Use the heuristic method discussed in class to find "good" locations for the new factories while trying to minimize the total weighted distance.
- Identify the best minimum weighted distance locations of two new factories by using the enumeration method discussed in class. Note: For parts b and c, clearly indicate the cities served by each open factory.