

IE102 Spring 2017 Homework II - Due: March 13, Monday 17:00

IMPORTANT: READ BEFORE YOU START WORKING ON THE HOMEWORK

Information on Homework II

- Homework II 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 in 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.**

Contact TA Ömer Burak Kinay if you have questions related to this HW: omer.kinay@bilkent.edu.tr

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

Question 1:

A manufacturer of spare parts for CNC machines (ABNT) has a plant located in Bolu. It sells its products throughout six cities: Adana, Gaziantep, İzmir, Yalova and Erzurum. ABNT is working contract based and therefore knows how many customers it should serve at each of these 6 cities. This information is given below:

	Adana	Gaziantep	İzmir	İstanbul	Erzurum	Sinop
Number of Customers	19	15	18	34	9	10
Distance from Bolu	677km	858km	598km	262km	966km	420km

The owner of the company, Mr. Kinay, has won the lottery and wants to use this prize money as efficient as possible to make his business better. The industrial engineers of the company have calculated that with this additional funds, the company has enough budget to open two new plants if it shuts down the leased Bolu factory. The candidate locations for these new factories are: İzmit, Manisa, Ankara, Kayseri and Sivas. The distance matrix of these new locations and the set of customer locations is as following:

	Adana	Gaziantep	İzmir	İstanbul	Erzurum	Sinop
İzmit	828	1009	453	111	1117	571
Manisa	884	1096	35	529	1438	975
Ankara	490	667	579	453	875	412
Kayseri	333	349	848	771	632	548
Sivas	423	415	1018	891	438	478

- Calculate ABNT's total weighted distance for the current case (The factory is at Bolu).
- 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.

Question 2:

An American manufacturer of automobile radiators has a factory located in Denver and 3 distribution centers (DCs) throughout the USA. The DCs collect customer orders and individually claim necessary units of radiators from the factory at the beginning of each month. The monthly demand at each of the three DCs along their distance to the factory located at Denver is shown below:

Distribution Center	Monthly Demand (#)	Distance from Denver (km)
New York	25000	2900
Los Angeles	35000	1600
Oklahoma City	20000	1100

The shipments can be delivered by train or truck. Capacity of each truck is 2000 units and each train is 12000 units. Transportation costs each mode of transport is as shown following:

Truck: $100 + 0.4x$ dollars.

Train: $3200 + 0.05x$ dollars.

(In these cost notations, x denotes the distance to be travelled in kilometers)

Using this information, identify the optimal transportation option (or transportation mix) and the associated cost for each DC for the given month.

Question 3:

Suppose you have just graduated from Bilkent University, and have received three job offers. In choosing which job offer to accept, you may consider the following criteria: (1) starting salary (SAL), (2) quality of life in city where job is located (QL), (3) interest in work (IW), and (4) job location near family and friends (NF). The tables below present the scale range and type used for each measure and data for each offer respectively.

<u>Measure</u>	<u>Range</u>
SAL	3000-5000
QL	1. Good 2. Average 3. Bad
IW	0-10
NF	1.Nearby 2.Within 4 hr drive 3.Far

<u>Measure</u>	<u>Offer 1</u>	<u>Offer 2</u>	<u>Offer 3</u>
SAL	4250	3100	5000
QL	2	1	3
IW	8	6	5
NF	3	1	2

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

Question 4:

The elections are approaching and Party*A officials are trying to decide on the type of campaign to carry in the next few months. There are known 4 possible alternative campaigns. The following table (**Table I**), containing relevant criteria, related performance measures and other details, was obtained in several meetings.

TABLE I Criterion	Measures	Least Preferred	Most Preferred	Points (0-100)	Weight
Monetary issues	Campaign expenses	20 000 TL	6 000 TL	85	
	Donor contribution	2 000 TL	9 000 TL	70	
Image upgrade	Image upgrade	1 (no)	5 (perfect)	100	
Policy generation	Social policies	1-not effective	3-very effective	30	
	Economic policies	1-not effective	3-very effective	50	
New members	Number of new, young members	1 000	50 000	90	
	Number of new members from academics	10	150	10	
	Number of new members from other parties	100	6000	65	
				500	1.000

The following data presented in **Table II** were collected for each alternative campaign, denoted by A1, A2, A3 and A4.

TABLE II Measures	Alternatives A1	A2	A3	A4
Campaign expenses (TL)	6 000	10 000	15 000	20 000
Donor contribution (TL)	2 000	3 000	2 000	9 000
Image upgrade	1	3	4	2
Social policies	1	2	3	2
Economic policies	2	3	1	2
Number of new, young members	1 000	30 000	50 000	35 000
Number of new members from academics	50	150	100	40
Number of new members from other parties	100	3 500	2 000	6 000

Given the above 2 tables answer the following questions:

- (5 points)** Complete the last column of **Table I** (sum of weights should be 1)
- (10 points)** Rescale each measure to “Common Units” from 0 to 1, with 0 the worst and 1 the best. Create **Table III**, the version of **Table II** with common units. Make explanations if necessary. Show your calculations.

c)

TABLE III	Alternatives	A1	A2	A3	A4
Measures	(in common units)				
	Campaign expenses				
	Donor contribution				
	Image upgrade				
	Social policies				
	Economic policies				
	Number of new, young members				
	Number of new members from academics				
	Number of new members from other parties				

d) (5 points) Calculate the total weighted score for the alternatives by filling **Table IV**. Show your calculations.

TABLE IV	Alternatives	A1	A2	A3	A4
Measures	Scores				
	Campaign expenses				
	Donor contribution				
	Image upgrade				
	Social policies				
	Economic policies				
	Number of new, young members				
	Number of new members from academics				
	Number of new members from other parties				
	TOTAL SCORE				