

IE102 Fall 2018 Homework V - Due: December 3, Monday 17:00

IMPORTANT: READ BEFORE YOU START WORKING ON THE HOMEWORK

Information on Homework V

- Homework V is 2%. 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 EA307 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 Gül Çulhan if you have questions related to this HW:

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Question 1: A manufacturer of furniture (FURNY) has a plant located in Manisa. It sells products through six cities: İzmir, Bilecik, Çanakkale, Eskişehir, Kütahya and Antalya. FURNY 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	Bilecik	Çanakkale	Eskişehir	Kütahya	Ankara
Number of Customers	100	90	120	80	150	110
Distance from Manisa	35	385	331	394	316	562

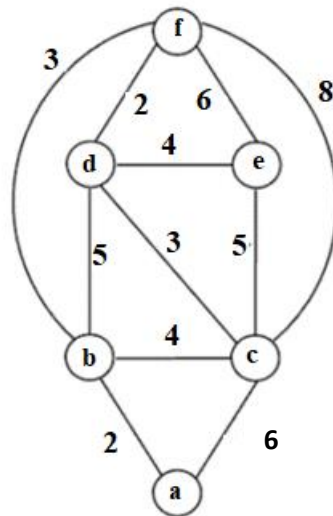
The company has enough budget to open two new plants if it shuts down the leased Manisa factory. The candidate locations for these new factories are: Aydın, Afyonkarahisar, Bursa and Uşak. The distance matrix of these new locations and the set of customer locations is as following:

	İzmir	Bilecik	Çanakkale	Eskişehir	Kütahya	Ankara
Aydın	126	520	452	477	408	597
Afyonkarahisar	326	212	526	144	100	256
Bursa	325	95	271	152	177	385
Uşak	211	251	421	217	139	367

- Calculate FURNY'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.

Question 2: A municipality is going to locate ambulances into the city and it is trying to find the locations of these ambulances. It is known that there are 6 major districts in the city (a...f). The exact locations of these districts are shown on the graph below, along with the travel time values between pairs (in minutes). The ambulances can only be located on the nodes.



- a) Construct the travel time matrix.
- b) What are the optimal ambulance locations if we want to minimize the total time of reaching every district while locating two ambulances.
- c) What is the minimum allowable time to cover every district in the shortest possible time using a single ambulance? (i.e. indicate the minimum time that every district is reachable by an ambulance) On which location(s) should the ambulance be located at in order to obtain this minimum time?
- d) Suppose that you want to find the minimum number of ambulances such that each district is reached in 5 minutes. First observe that optimum objective function value is 2.
 - i. Please state all optimum solutions with 2 ambulances.
 - ii. In order to select from the alternative optimums use the following additional measures.
 - Minimize time to reach every district
 - Minimize worst time to reach a district
 - Minimize the number of twice covered districts

Give the nondominated solutions by also stating the dominances.
 - iii. Suppose that the weight of each measure is as shown below. List the location combinations in preference order according to their total scores.

• Minimize time to reach every district:	0.2
• Minimize worst time to reach a district:	0.3
• Minimize the number of twice covered districts:	0.5