

GROUP DECISION MAKING UNDER MULTIPLE CRITERIA
MIDTERM EXAM

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You may use lecture notes and other related printed sources as well as your computer.
Allowed programs are **pdf readers** for reading pdf files, and **MS Excel** for mathematical calculations.
Other programs are strictly forbidden to use.
Please turn off Internet property of your computer.

Duration: 2 hours

QUESTIONS

1. (15 points) Explain the following criteria that are used to analyze the properties of voting methods and indicate which Arrow's condition(s) is related to each criterion:
 - Pareto
 - Monotonicity
 - Participation
 - Independence of clones
 - Transitivity
2. (11 points) How voting methods can be integrated into multiple attribute group decision making approaches. Explain with examples.
3. (15 Points) Please analyze the methodology proposed in Tavana and Hatami-Marbini (2011), using the Generic Conceptual Framework for Multiple Attribute Decision Making introduced in the class.
4. (15 points) Explain briefly the logic of the voting system in Caklovic and Kurdija (2017) with your own words. What are the favorable parts? In which situations can it be applied? etc.
6. (22 Points) The board of directors of ATK-holding would like to determine executive committee of 3 members. The list system is used for the selection process. That is, the board members vote to the four lists (a, b, c, d), each of which has 3 candidates. Preferences of the board members are given as follows:

No. of voters	Ranking
12	$a > b > c > d$
7	$a > c > b > d$
7	$b > c > d > a$
5	$d > b > c > a$
3	$c > d > b > a$
8	$d > c > a > b$

- a) Initially, suppose only the first preferences of the voters are considered. Find the number of seat that will be allocated to the lists (a, b, c, or d) using the greatest remainder method with Droop quota.
- b) Now consider the full preferences (rankings) of the voters. How would you integrate the preferences to the voting system? Distribute the seats to the lists considering the preferences of the voters using an appropriate method.

5) (22 Points) Solve the following MAGDM problem using an ELECTRE based methodology. You may use an existing approach or propose your own approach. Please first explain the methodology you will apply.

A bicycle-manufacturing company intends to advertise its products. The final considerations have narrowed down to four marketing actions: International Newspaper (IN), Poster (P), Mail (M), and TV. These alternatives are evaluated based on three objective (Cost, Market, Employees) and two subjective criteria (Endurance, Effectiveness). The subjective criteria are evaluated by two experts. The first expert used 1-10 scale in her evaluation while the second one prefers 1-5 scale.

	Cost (1000 TL)	Market (number of customers reached in 1000)	Employees (number)
<i>Type of attribute -></i>	<i>Cost</i>	<i>Benefit</i>	<i>Cost</i>
Weights (1-7 scale)	4	6	5
International Newspaper	50	650	4
Poster	40	620	2
Mail	90	750	3
TV	65	900	6

	Endurance		Effectiveness	
<i>Type of attribute -></i>	<i>Benefit</i>		<i>Benefit</i>	
	Expert 1	Expert 2	Expert 1	Expert 2
Weights (1-7 scale)	3	4	5	2
International Newspaper	4	3	6	2
Poster	3	4	9	4
Mail	8	5	7	3
TV	5	3	5	5

Which marketing action would you suggest?

Good luck!

References:

Tavana, M., & Hatami-Marbini, A. (2011). A group AHP-TOPSIS framework for human spaceflight mission planning at NASA. *Expert Systems with Applications*, 38(11), 13588-13603.

Caklovic, L., & Kurdija A.S. (2017). A universal voting system based on the Potential Method, *European Journal of Operational Research*, 677–688