

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. (20 points) After the resignation of their previous CEO, Board of Directors of ATK-Holding is trying to select a new CEO for their holding. 29 members of the board voted their first and second preferences out of four candidates (see Table below for the votes).

First preference	Second preference	Number of votes
Ançi	Cansever	2
Buyukorman	Ançi	6
Buyukorman	Cansever	3
Cansever	Ançi	5
Cansever	Buyukorman	1
Cansever	Denizli	4
Denizli	Ançi	8

- Find the new CEO of the holding using election by simple majority rule.
 - Does the answer in part (a) change if the second ballot method is used?
 - According to the Condorcet Principle, is there a Condorcet winner?
 - Is it possible to use Single Transferable Vote method for this problem? If it is possible use it, otherwise use another appropriate social choice function to find the new CEO.
2. (15 Points) In the list system (i.e., system of voting the party ticket), the idea is to have a common ratio between seats and votes. Formulate a mathematical program to find the number of seats assigned to parties when parties' numbers of votes are given.
3. (15 Points) Which of Condorcet's Function and Borda's function violate Arrow's conditions 2 and 3? Give contradictory examples for the function(s) to illustrate they violate Arrow's conditions 2 and 3.
4. (15 Points) Consider the "Conceptual Framework for MAGDM" introduced in the class. In which parts of this framework, process oriented approaches can be used? Explain your answer.
5. (20 Points) Solve the problem defined in Shih et al. (2007)* using the agreed criteria approach or individual criteria approach (select the appropriate one) in Hwang and Lin's GDM Process. Compare your results with the results of Shih et al. (2007).

*H.-S. Shih, H.-J. Shyur, E. Stanley Lee, An extension of TOPSIS for group decision making, Mathematical and Computer Modelling 45 (2007) 801–813.

6. (15 Points) Brown family is planning to buy a new car. On their decision to determine the model of the car, they have specified price, comfort, and design as the selection criteria. Family members evaluated the criteria in pairwise manner to find the importance weights:

- Mr. Brown thinks that price is *much more important* than comfort and design. And comfort is *somewhat more important* than design.
- Mrs. Brown evaluates comfort is *very much more important* than price and *absolutely more important* than design. And price is *somewhat more important* than design.
- Yellow, the son of the family, thinks that the design is *very much more important* than price and comfort, while comfort and price are *equally important*.

Find the importance weights of the criteria for the family depending on below given Saaty's rating scale under the following restrictions.

- Assume all family members have the same voting power.
- Suppose attributed to her dominance in the family decisions Mrs. Brown has two times more voting power compared to Mr. Brown and Yellow has only half voting power compared to his father. What would be the importance weight of the criteria in this situation?

Saaty's rating scale	
Intensity of importance	Definition
1	Equal importance
3	Somewhat more important
5	Much more important
7	Very much more important
9	Absolutely more important
2,4,6,8	Intermediate values