GROUP DECISION MAKING UNDER MULTIPLE CRITERIA

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FINAL EXAM

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You may use lecture notes and other related printed sources as well as your computer for soft documents and mathematical calculations. You should turn of internet property of the computer.

Duration: 3 hours

QUESTIONS

1. (10 points) What are the differences between process oriented approaches and content oriented approaches? Is it possible to integrate the concept of process and content oriented apaches for some kind of problems?

2. Suppose a hypothetical city, Tekelonya, where 895,151 votes are cast for five party lists contesting five seats and suppose the distribution of votes is as follows:

Journey Party	182,557
Bribe Lovers Party	362,191
Movement Party	114,697
Winter Sleep Party	52,342
Jobs and Powers Party	183,364

   a. (15 Points) Allocate seats to party lists by using D' Hondt's rule and Greatest remainder method with droop quota. Compare the results based on the characteristic of the methods.
   b. (10 Points) Proportional representation (PR) is a concept in non-ranked voting systems used to elect two or members. PR means that the number of seats won by a party or group of candidates is proportionate to the number of votes received. Formulate a mathematical programming model for the given example to determine the number of seats according to the concept of proportional representation.

3. (20 Points) Suggest a classification scheme for explicit group decision making approaches. Classify the following papers, which are analyzed in the class, accordingly.
   - A.İ. Ölçer, A.Y. Odabaşi, A new fuzzy multiple attributive group decision making methodology and its application to propulsion/manoeuvring system selection problem, European Journal of Operational Research, Volume 166, Issue1, 2005, Pages93-114
   - Xu, Z. (2004) Uncertain linguistic aggregation operators based approach to multiple attribute group decision making under uncertain linguistic environment, Information Sciences 168, 171–184
   - Ignacio Javier Pérez, Francisco Javier Cabrerizo, and Enrique Herrera-Viedma, A Mobile Decision Support System for Dynamic Group Decision-Making Problems, IEEE Transactions ON Systems, Man, and Cybernetics—Part A: Systems and humans, VOL. 40, NO. 6, 2010

4. Brown family is planning to buy a new car. On their decision to determine the model of the car, they have specified three alternatives: BMW 316i, Mercedes C180, and Audi A4. In order to make the final decision family members evaluated the alternatives in pairwise manner using Saaty's scale as in the following tables.

   a. (12 Points) Use a soft consensus measure to find the weights of the family members, and aggregate the evaluations based on these weights.
   b. (13 Points) Use a soft proximity measure to find proximity of each family member to the aggregate score.

Mr. Brown	BMW 316	Mercedes C180	Audi A4
BMW 316	1	5	7
Mercedes C180	1/5	1	2
Audi A4	1/7	1/2	1

Mrs. Brown	BMW 316	Mercedes C180	Audi A4
BMW 316	1	1/5	1/4
Mercedes C180	5	1	1/3
Audi A4	4	3	1

Yellow	BMW 316	Mercedes C180	Audi A4
BMW 316	1	1	1/3
Mercedes C180	1	1	1/4
Audi A4	3	4	1

5. (25 points) A software company desires to hire a system analysis engineer among three candidates A1, A2 and A3 who are evaluated by a committee of 3 decision makers against three benefit criteria; i.e. emotional steadiness (C1), oral communication skills (C2), personality (C3). The relative importance weights of 3 criteria are described using linguistic variables such as Low, Medium etc. (see Table 1). Ratings (i.e. criteria values) are also characterized by linguistic variables such as Poor, Fair, Good as (see Table 2)

Table 1.

Liguistic variables	Fuzzy Number
Very low (VL)	(0,0,0.1)
Low(L)	(0,0.1,0.3)
Med. L(ML)	(0.1, 0.3, 0.5)
Med.(M)	(0.3, 0.5, 0.7)
Med. High (MH)	(0.5,0.7,0.9)
High (H)	(0.7, 0.9, 1.0)
Very High (VH)	(0.9, 1.0, 1.0)

Table 2.

Liguistic variables	Fuzzy Number
Very Poor(VP)	(0,0,1)
Poor(P)	(0,1,3)
Medium Poor (MP)	(1,3,5)
Fair (F)	(3,5,7)
Med.Good (MG)	(5,7,9)
Good (G)	(7,9,10)
Very Good (VG)	(9,10,10)

Three DMs Express their opinions on the importance weights of the 3 criteria and their ratings of each candidate with respect to 3 criteria are given individually (see Table 3 and Table 4 respectively).

Table 3.

Criterion	DM1	DM2	DM3
C1	H	VH	MH
C2	VH	VH	VH
C3	VH	H	H

Table 4.

Criterion	**Candidate**	**DM1**	**DM2**	**DM3**
C1	A1	MG	MG	MG
	A2	G	MG	MG
	A3	VG	MG	F
C2	A1	G	MG	F
	A2	VG	VG	VG
	A3	MG	G	VG
C3	A1	F	G	G
	A2	VG	VG	G
	A3	G	MG	VG

The importance of decision makers for the evaluation of the candidates according to three criteria are given in Table 5.

Table 5.

	Importance of Decision Makers		
Criterion	**DM1**	**DM2**	**DM3**
C1	0.3	0.5	0.4
C2	1	0.6.	0.3
C3	0.7	1	1

Find the most appropriate candidate according to aggregated group decision, using an appropriate fuzzy group decision making approach which depends on an outranking MADM method. (You may use an existing method analyzed in the class or create a new one)

GOOD LUCK!