MATH-H-405 – Decision engineering

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Academic year 2010/2011 – Second session exam

LAST NAME:

FIRST NAME:

SECTION:

Please give precise and concise answers and use the notations from the course.

Question 1	Question 2	Question 3	Question 4	Total (/40)	Total (/20)

Question n°1 – Multi-criteria decision aid

In the context of a multi-criteria problem, describe the different steps needed to obtain the PROMETHEE I ranking.

Question n°2 – Game theory

Describe the « prisoner's dilemma » problem.

Why is this problem particularly interesting in the game theory context?

Question °3 – Voting theory

We consider a voting problem where a candidate is elected when the Condorcet method is applied. If this candidate improves his position in the preferential ranking of at least one voter, we are sure that this candidate will still be elected. Demonstrate this statement or give a counter-example.

Question n°4 – Decision under uncertainty

We want to optimize the process of a dispatching service at a fire department unit in order to reduce the process time of the calls. In order to simplify the problem, we consider two types of intervention:

- Routine interventions: they represent 70% of the interventions and they need 10 minutes to be dispatched
- Emergency interventions: they represent 30% of the interventions and they need 20 minutes to be dispatched

(a) What is the mean dispatching time?

(b) In order to optimize the mean dispatching time, we consider the following system: the calls are processed by an answering machine that asks 3 standard questions. The answers are limited to yes or no (with the phone keypad). If the call refers to an emergency intervention, we are sure that there will be one yes in the answers. However, due to stress, 25% of the calls for a routine intervention will lead to at least one yes in the answers. Answering the questions takes 3 minutes. We consider that the given answers will reduce the dispatching time of a routine intervention from 10 minutes to 5 minutes. What is the mean dispatching time in this context?

(c) The calls where there is at least one yes in the answers are redirected to a second round of questions that takes 3 minutes to be completed. Those new questions will allow to reduce the dispatching time of the emergency interventions from 20 minutes to 12 minutes (here again, if the call refers to an emergency intervention, we are sure that there will be at least one yes). On the other hand, only 10% of the calls for a routine intervention will lead to at least one yes in the answers with this second round of questions. What is the mean dispatching time in this context?