

# Intelligent Systems: Reasoning and Recognition

James L. Crowley

ENSIMAG 2 / MoSIG M1

Practice Exam

Conditions: You have the right to use any notes or written material. You may answer questions in English or in French. When appropriate, illustrate your answer with mathematics. Your written answers must be clear and legible. Illegible text will not be graded. Duration: 3 hours.

1) (4 points) Write a critical evaluation of the technology for expert systems. What can be done with these techniques? What are the limitations?

2) (4 points) Assume the following class definitions in CLIPS:

```
(defclass PERSON (is-a USER) (role abstract)
  (slot ID (create-accessor read-write))
  (slot father (create-accessor read-write))
  (slot mother (create-accessor read-write))
  (multislot brothers (create-accessor read-write))
  (multislot sisters (create-accessor read-write))
)
```

```
(defclass MAN (is-a PERSON)
  (role concrete)(pattern-match reactive)
  (slot wife (create-accessor read-write) (default unknown))
  (slot gender (storage shared)(default male) (create-accessor read))
)
```

```
(defclass WOMAN (is-a PERSON)
  (role concrete)(pattern-match reactive)
  (slot husband (create-accessor read-write) (default unknown))
  (slot gender (storage shared) (default female)
    (create-accessor read))
)
```

a) Create a set of rules to build a family structure by asking for the wife for each man, the husband for each woman, and the father and mother for each person. Name these rules (ask-wife, ask-husband, ask-father, ask-mother).

b) Define a set of message handlers for the class PERSON that can determine the names of the paternal and maternal grandparents.

3) (4 points) Assume the following temporal relations between intervals A, B, C and D.

Event A before Event B :	(A < B)
Event B during event D :	(B d D)
Event A starts event C:	(A s C)
Event D overlaps event C :	(D o C)

a) What are the possible relations of A to D obtained by transitivity with B?

b) What are the possible relations of A to D obtained by transitivity with C?

c) What are the possible relations of A to D after constraint propagation?

4) (8 points) You have been hired as a political analyst. You are working on the political campaign for a referendum. Your job is to identify the sectors of the population for which you can design targeted publicity. For this you prepare a questionnaire for a poll. Each question has a small number of possible response. The questions are as follows:

- 1) What is your age? A) 18-29, B) 30-39, C) 40-49, D) 50-59, E) 60 or older
- 2) What is your sex? A) Male, B) Female.
- 3) What is level of education? A) High-school B) University Bachelor, C) Masters Degree D) Doctorate, E) Other.
- 4) What is your annual Salary? A) < 15 000 B) 15 001 to 30 000 C) 30 001 to 60 000 D) 60 001 to 90 000, E) More than 90 000.
- 5) How will you vote in the referendum? A) Yes, B) No, C) Undecided, D) I do not plan to vote.

a) (2 points) For the group who have responded A or B in Question 5, explain how to use a ratio of histograms to predict the most likely vote for each category of age. How many persons should be polled? How can you determine the probability of error for your prediction?

b) (2 points) Explain how to use a ratio of histograms to predict the response to question 5 as a function of the answers to questions 1, 2, 3, and 4. How many people must you poll? How can you predict the probability of error?

c) (2 points) Explain how to use a quadratic discrimination formula to predict the response to question 5 given the responses to questions 1, 2, 3, and 4.

d) (2 points) Explain how to use the EM algorithm to discover categories of voters who are likely to vote non given their responses to questions 1, 2, 3, and 4.