

# Intelligent Systems: Reasoning and Recognition

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ENSIMAG 2 / MoSIG M1

Final Exam - May 2010

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) Explain Baye's rule for someone who has a phobia of mathematics. Under what circumstances can it be used? Under what circumstances is it false? Can Baye's rule be used to classify events based on qualitative (non-ordinal) symbolic features such as color or favorite music?

2) (4 points) You are asked to replace the confidence factor, CF, with Probability in the MYCIN system. How does this change the way rules determine the confidence in facts? What is the new formula for Combine? Where would you get the probabilities for the facts and the rules? How will this change the results?

3) (4 points) Explain the difference between the following two CLIPS rules. Is one of the rules more efficient than the other? Explain your response.

```
(defrule A (person (nom ?n1) )
  (person (nom ?n2&:(neq ?n1 ?n2)))
=> )
```

```
(defrule B (person (nom ?n1))
  (person (nom ?n2))
  (test (neq ?n1 ?n2))
=> )
```

4) (4 points) Graphsearch for metro planning

You have been hired to write a program to provide the fastest route through a subway (metro) network using heuristic search. What cost function do you propose? Can you propose a heuristic for which the search is optimal? If yes, provide the conditions for optimality. If no, explain why not.

5) (4 points) You have been given a results from a questionnaire of 100 persons with 3 professions: Class 1: factory worker, Class 2 teacher, class 3: salesman. You know that this data contain results from 50 factory workers, 10 teachers and 40 salesmen, but you do not know the profession for the person who completed each questionnaires. You also know the following

- Factory workers earn an average salary of 20 Euros/hour, with standard deviation of 2 euros/hour.
- Teachers earn an average of 30 euros an hour with a standard deviation of 4
- Salesmen earn an average salary of 20 Euros an hour with a standard deviation of 6

a) How can you use the salary to determine the probability that a person from the training set belongs to each of the three classes.

b) What is the probability of error for deciding that the person belongs to the most likely class.

c) What kind of classifier would you propose to detect salesmen in this data? Why?

d) Is there a Bayesian classifier that can detect teachers in this data? If yes, then which one. If no, why not?