

Intelligent Systems : Reasoning and Recognition

James L. Crowley

Second Year ENSIMAG

Final Exam - May 2008

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) Provide a definition of knowledge and a explanation of knowledge representation for a non-specialist. What different forms of knowledge can be identified? For what sorts of tasks may be performed with different representations? What are the limitations? How is knowledge acquired?

2) (3 points) Given the following deftemplates:

```
(deftemplate product (slot product-name))  
(deftemplate brand (slot product-name)(slot brand-name)(slot price))
```

The following rule is intended to display the brand-name and price of the lowest cost item for each product name. Complete the rule.

```
(defrule "find cheapest brand"  
  ...  
->  
  (printout t "The cheapest ?N is sold by ?B for ?P Euros." crlf)  
)
```

3) (3 points) Given the following temporal relations:

Event A before Event B:

Event B during Event D:

Event A starts Event C:

Event D overlaps Event C:

- What relations are possible between D and B by transitivity with A?
- What relations are possible between D and B by transitivity with C?
- What relations are possible between D and B after constraint propagation?

4) (4 points) Provide a definition and an explanation for an ROC curve? How is it calculated? For what can it be used?

5) (6 points) You are responsible for an International Masters program. Over the last 5 years, your program has accepted 200 students from three Universities. You wish to use the academic results of these students in two of your courses in order to provide guidelines for admissions for future students. For each student, you have the name of his university, his ranking in the last year of studies at his home university, and the grades that he has obtained in the two reference classes in your program.

- Explain how to use a ratio of histograms to estimate the origin of a student from his grades in your reference classes? Present the formula and explain its terms? How can you estimate the probability of error? How many students from each University are necessary in order for a ratio of histograms to give a reasonable result.

b) Bad Luck! There are not enough students to use a ratio of Histograms. Explain how to use normal (Gaussian) probability density functions to estimate to calculate the probability that a student is from one of the three Universities given his notes in your two reference classes. Explain how to estimate the parameters for the Normal density functions. Can you determine a probability of error for the origin of the students? If yes, how is it determined.

c) You have really bad luck! Your secretary has erased the country of origin of your students. All you have are their notes in your two reference classes. Explain how to use the EM algorithm to estimate a normal probability density function for each of the three groups. Explain how to initialise your parameters.