

Intelligent Systems: Reasoning and Recognition

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ENSIMAG 2 / MoSIG M1

Session 2 Exam - July 2014

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 will it give incorrect results? Can Baye's rule be used with symbolic features such as hair color or nationality?

2) (3 points) Given the following temporal relations:

Event A before Event B:	(A > B)
Event B during Event C:	(B o C)
Event A overlaps Event D:	(A o D)
Event C starts Event D:	(C di D)

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

3) (3 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) Given the following deftemplates in CLIPS:

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

Write a rule in CLIPS named "Ask-Product-Type" that will ask the user to enter a product-type and create a working memory element (a fact) for the product type. Write a second rule named "Find-least-expensive" that will select and print the brand and price of the least expensive product for the product-type named in the fact.

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, noted as numeric grade from 0 to 20.

a) 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 large are the histograms? How many students from each University are necessary in order for a ratio of histograms to give a reasonable result? How can you estimate the probability of error?

b) Bad Luck! There are not enough students to use a ratio of Histograms. Explain how to use a normal (Gaussian) probability density functions to estimate 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 information about the origin of your students. All you have are their notes in your two reference classes. Explain how to use the EM algorithm to estimate the probability that each student belongs to each of the three universities. Explain how to initialize the parameters for the algorithm.