

DUBLIN INSTITUTE OF TECHNOLOGY  
KEVIN STREET, DUBLIN 8

---

BSc COMPUTER SCIENCE

YEAR 4

---

**SUPPLEMENTAL EXAMINATIONS 2003**

---

KNOWLEDGE BASED DECISION SUPPORT SYSTEMS

MR. CIARÁN O'LEARY

DR. BRENDAN O'SHEA

PROF. A.T. WHITEHOUSE

Answer **FOUR** questions

**All questions carry equal marks**

1. (a) Give a detailed account of Minsky's theory of *Frames*, and how they relate to *vision*, *language* and *memory*. **(15 marks)**
- (b) Explain why, in your opinion, *Knowledge Representation* is so difficult. **(5 marks)**
- (c) Give an overview of Rodney Brooks' philosophy in relation to knowledge representation. State your opinion on these ideas. **(5 marks)**
2. (a) Compare and contrast *data driven* and *goal driven* search strategies. **(5 marks)**
- (b) Using an example search problem, explain how any heuristic of your choice can be applied to make the solution of the problem more manageable for a computer program. **(5 marks)**
- (c) In your opinion, can a computer that performs simple search in order to solve a problem be considered an intelligent machine? In your answer you should reference appropriate authors on the subject. **(7 marks)**
- (d) Explain in detail what is meant by the term *semantic web* and how it can be used as a distributed knowledge base. **(8 marks)**
3. (a) Explain, using detailed examples, the difference between *monotonic* and *non-monotonic* reasoning. **(8 marks)**
- (b) Discuss the motivation behind using fuzzy logic. In your answer you should give an example of how fuzzy logic can be used in a particular problem domain. **(8 marks)**
- (c) Using an example, demonstrate the usefulness of the Stanford Certainty Factor Algebra. **(9 marks)**

4. (a) State and explain Bayes' theorem. **(3 marks)**
- (b) In what type of situations is Bayesian reasoning useful? **(4 marks)**
- (c) Discuss why Bayesian reasoning should be avoided in certain circumstances, and what substitutes can be used in its place. **(7 marks)**
- (d) A new analytical method to detect pollutants in water is being tested. This new method of chemical analysis is important because, if adopted, it could be used to detect three different contaminants: organic pollutants volatile solvents and chlorinated compounds, instead of having to use a different test for each pollutant.
- The makers of the test claim that it can detect high levels of organic pollutants with 99.35% accuracy, volatile solvents with 99.15% accuracy and chlorinated compounds with 82.7% accuracy. If a pollutant is not present, the test does not signal. Samples are prepared for the calibration of the test and 50% of them are contaminated with organic pollutants, 32% with volatile solvents and 18% with traces of chlorinated compounds.
- A test sample is randomly chosen.
- (i) What is the probability that the test will signal?  
(ii) If a test signals, what is the probability that chlorinated compounds are present. **(11 marks)**
5. (a) Describe in detail each of the following types of expert systems **(15 marks)**
- (i) Case based reasoner  
(ii) Rule based reasoner  
(iii) Model based reasoner
- (b) Describe the process of building an expert system, by focussing on the technology employed and the people involved. **(10 marks)**

6. (a) Describe in detail what is meant by a *conceptual graph*. In your answer you should use detailed examples to demonstrate the full capabilities of this model.

**(15 marks)**

- (b) Describe in detail Shanks' conceptual dependency model.

**(10 marks)**