

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF APPLIED SCIENCE
COMPUTER SCIENCE DEPARTMENT
MAY EXAMINATIONS 2002

SUBJECT: ARTIFICIAL INTELLIGENCE
CODE: SCS 4110

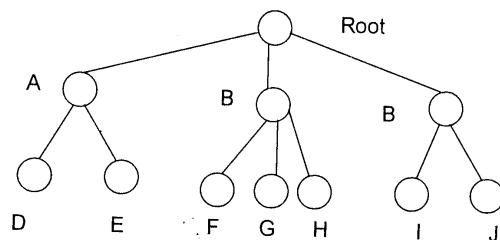
INSTRUCTION TO CANDIDATES

Answer any five questions.
Paper contains Seven questions.

Time: 3 hours

QUESTION ONE

- (a) Distinguish between conventional programs and Artificial Intelligence programs [8]
- (b) Compare and contrast the two state-space search strategies of branch-and-bound search and depth first search. Use the state-space graph given below to articulate your answer. [8].



- C) Define the following terms.
- semantic network.
 - parsing
 - knowledge representation
 - inference

[4]

QUESTION TWO

- a) Explain in detail the operation of the predicate *foo/2* defined by

```
foo(A,B):-
    append(D, [E, F | G],A),
    F>E,
    append( D, [F,E | G], H),
    !,
    foo(H,B).
```

given the query

```
foo([12,6,18,4,3],Y). [8]
```

- b) Describe briefly, what is (as well as the architecture) a backpropagation network in neural networks [8]
- c) Derive the skolem form of the following expression
 $\exists u \forall v \forall x \exists y [P (f (u), v, x, y) \longrightarrow Q(u, v, y)]$ [4]

QUESTION THREE

- a) Compare and contrast the following knowledge representation system giving at least two advantages and disadvantages of each: frame system and formal logic (FOPL) system. [8]
- b) For each of the following pairs of sentences, identify any ambiguity of syntax, semantics or discourse. Describe the knowledge needed to resolve the ambiguity in each case, and indicate how it might be incorporated in an automated Natural Language Processing system.
- i) (conversation in a shop)
Keletso : "Do you have any money"
Nothando : "What do you want to buy?"
 - ii) The hunters fired at the deer and some of them missed.
The hunters fired at the deer and some of them fell.
 - iii) Time flies like an arrow
Fruit flies like a pear. [12]

QUESTION FOUR

- a) A key aspect of AI systems is the scope of application. This can be describe as having three levels [formal systems, micro-world system, real world system]. Describe and contrast these three levels, giving an example of an AI system, which has been developed for each level [8]
- b) In order to apply backpropagation networks to a real world problem, a number of steps must be taken. Select one real world application area of backpropagation, state and consider in as much detail as possible what steps are involved and how there are resolved in building such a system. [12]

QUESTION FIVE

- a) Explain briefly the distinction between syntax, semantics, discourse and pragmatics in Natural Language understanding. [8]
- b) Given the following facts,
A= Have \$10 000
B= Younger than 30 years
C=Education at college level
D= Annual Income of at least \$40 000
E= Invest in securities
F=Invest in growth stocks
G= Invest in IBM stocks.
And the following rules
R1: if A and C then E
R2: if D and C then F
R3: If B and E then F
R4: if B then C
R5: if F the G
Assume that an investor has \$10000 (i.e. A is true) and she is 25 years old (i.e. B is true). Use forward chaining to give her advice whether or not to invest in IBM stocks (i.e. Yes-Invest- or No-do not invest-).
Draw an inference tree (for the above forward chaining). [12]

QUESTION SIX

- a) Given the following rule by Vet about a dog's symptoms and corresponding diagnosis of Dogish-HIV.

If : The dog has a chronic disorder, and the gender of the is female and the age of the dog is less than 5, and the dog shows condition A and Test B reveals biochemistry C.

Then: conclude the dog's diagnosis is Infectious-Dogish-HIV.

Write this rule in prolog. [8]

- b) Convert the following expression in to clausal form

$$\forall y \exists x [\forall z P(x, z) \& \exists w Q(w, z)] \longrightarrow [\exists x R(f(x), y, z) \& \exists v S(y, v)] \quad [8]$$

- c) Define a parser. Parsing is a search problem, it can be approached in two basic ways.
State and briefly explain what these basic ways are? [4]

QUESTION SEVEN

- a) What are the limitations of monotonic systems e.g. logic based system, in real life environments. [6]
- b) Describe the search mechanism that is carried out by prolog in answering a query. [8]
- c) Explain the difference between forward and backward chaining and under what conditions each would be best to use for a given set of problems. [6]

END OF QUESTION PAPER

GOOD LUCK!