(26)

MCS-102 : Artificial Intelligence
M.Sc. Computer Science
Semester First, Nov/Dec-2017

Time: Three Hours **Max. Marks: 70**

Attempt all questions.
Parts of a question must be answered together

1. a) What is Turing test approach to Artificial Intelligence? List the similarities and differences between Turing Test approach and Rational Agent approach.

[4]

b) Show with the help of an example that the composition of substitution is not commutative.

[2]

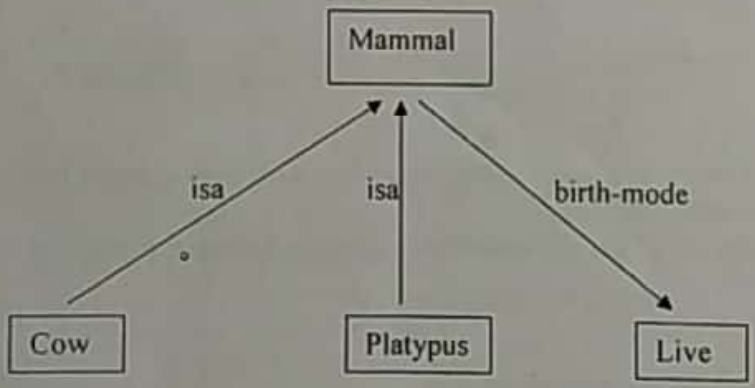
c) Describe the differences and similarities between problem solving and planning.

[4]

2. a) Describe various types of knowledge representation techniques with the help of an example for each representation.

[6]

b) Property inheritance is very common form of default reasoning. Consider the semantic net



How this semantic net will appear when the additional fact that the platypus lays eggs is inserted into it?

[4]

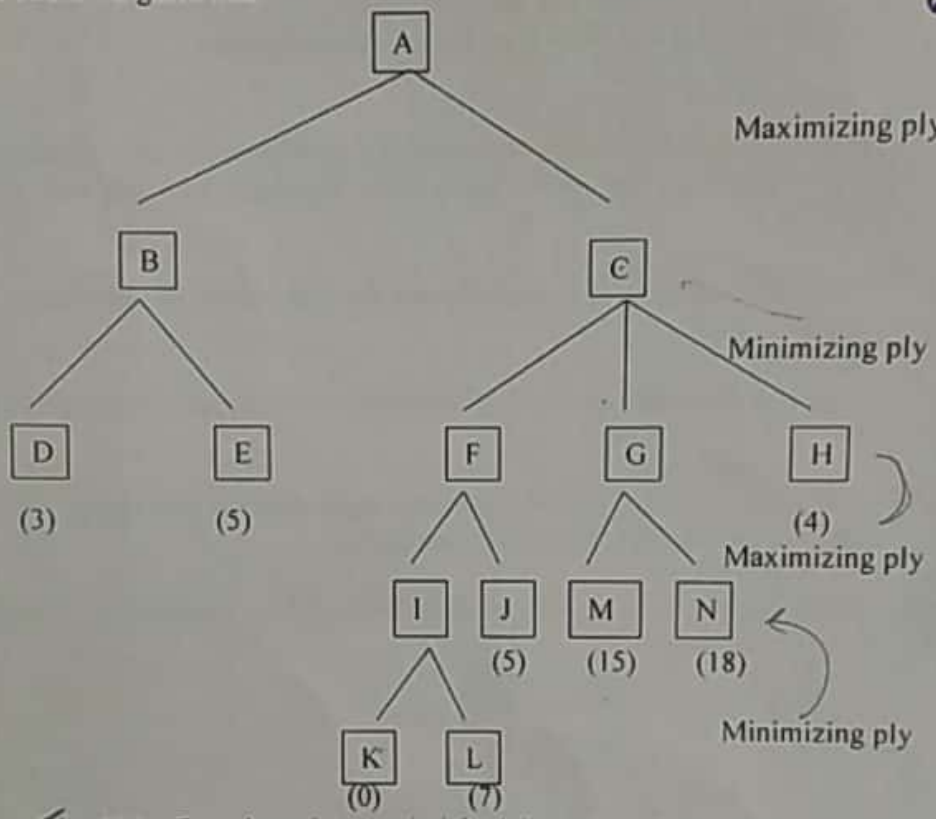
3. a) Determine whether each of the following sets is unifiable. If yes, obtain a most general unifier.

i. $w = \{Q(u, v, w), Q(x, h(x, y), x)\}$
ii. $w = \{Knows(Mother(y), y), Knows(z, z)\}$

[4]

b) You are explaining the problem of searching for a move in chess to your friend. Your friend notices that the algorithm needs to find the maximum of some function (i.e., the move that is best for you) and suggests that one should simply differentiate the function, set the result to zero, and solve. Explain why this will not work. [6]

4. Given below a game tree:



a) If the first player is a maximizing player then what move should be chosen under min-max procedure?

b) What nodes would not be needed to be examined using α-β pruning procedure?

[3+7]

5. Consider the following piece of knowledge:

- Mary, Micky and John are members of Rotary club.
- Every Rotary club member who is not a swimmer is a mountain climber.
- Mountain climbers do not like rains.
- Anyone who does not like water is not a swimmer.
- Micky dislikes whatever Mary likes and likes whatever Mary dislikes.
- Mary likes rain and water.

(i) Represent this knowledge as predicate statements.

(ii) Show that a query "Is there a member of Rotary club who is not a mountain climber but a swimmer" using resolution method. [10]

a) Write a Prolog program to find the factorial of a given number n. [3]

b) Consider the following block world problem and solve it using goal stack planning

Start: ON(C, A) ∧
ONTABLE (A) ∧
ONTABLE (B) ∧
ARMEMPTY

goal: ON (A, B) ∧
ON (B, C)

[7]

a) Explain (with the help of examples) that how and when
(i) ! (cut)
(ii) !, fail
are used in Prolog to change the backtracking sequencing. [4]

b) Develop a parse tree for the sentence "Every teacher likes a hard-working student" using the following rules.

S → NP VP
VP → V NP
NP → DET N
N → ADJ N
N → student | course | teacher | John
V → teaches | likes
ADJ → hard-working
DET → a | every

[6]

AI

MCS-102 : Artificial Intelligence
M.Sc. Computer Science
Semester I, Nov-2014

Time: Two Hours

Max. Marks: 50

Attempt all questions.
Parts of a question must be answered together.

1.

a) What is Turing test approach to Artificial Intelligence? List the similarities and differences between Turing Test approach and Rational Agent approach. [4]

b) Discuss and compare hill climbing and best-first search techniques. [4]

c) Show with the help of an example that the composition of substitution is not commutative. [2]

2.

a) Consider the following sentences:
"Meena eats all kinds of food. Pizza is a food. Apple is a food. Anything anyone eats is a food. Rahul eats chicken. Anita eats everything Meena eats."

i) Translate these sentences into formulae in Predicate Logic.
ii) Use resolution algorithm to answer the question "What food does Anita eat?" [4]

b) Write a Prolog program to find the factorial of a given number n. [3]

c) Write a Prolog program for reversing a given list. [3]

3.

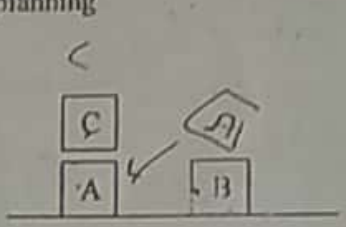
a) Describe various types of knowledge representation techniques with the help of an example for each representation. [6]

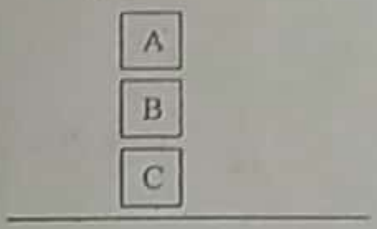
b) What do you understand by underestimation and overestimation of a heuristic function? Under what conditions A* gives optimal solution. [4]

4.

(a) Describe the differences and similarities between problem solving and planning [3]

(b) Consider the following block world problem and solve it using goal stack planning





Start: ON(C, A) ∧
ONTABLE (A) ∧
ONTABLE (B) ∧
ARMEMPTY

goal: ON (A, B) ∧
ON (B, C)

[7]

5.

(a) Explain (with the help of examples) that how and when,
(i) ! (cut)
(ii) fail
are used in Prolog to change the backtracking sequencing.

[4]

(b) Develop a parse tree for the sentence "Every lecturer likes a bright student", using the following rules.

S → NP VP
VP → V NP
NP → DET N
N → ADJ N
N → student | course | lecturer | John
V → teaches | likes
ADJ → bright
DET → a | every

[6]

MCS-102 : Artificial Intelligence

M.Sc. Computer Science

Semester I, Nov-2015

Time: Three Hours

Max. Marks: 70

Attempt all questions.
Parts of a question must be answered together

1. a) In what context did Turing suggest his well-known test? Explain the (Turing) test. Also explain how Turing test approach is different than Rational agent approach to AI? [4]

b) Consider the following piece of knowledge:

- Mary, Micky and John are members of Rotary club.
- Every Rotary club member who is not a swimmer is a mountain climber.
- Mountain climbers do not like rains.
- Anyone who does not like water is not a swimmer.
- Micky dislikes whatever Mary likes and likes whatever Mary dislikes.
- Mary likes rain and water.

i) Represent this knowledge as predicate statements.
ii) Show that a query "Is there a member of Rotary club who is not a mountain climber but a swimmer" using resolution method. [6]

2. a) Write an algorithm that will take as input two web page URLs and find a path of links from one to the other. What is an appropriate search strategy? Is bidirectional search a good idea? Could a search engine be used to implement a predecessor function? [4]

b) Describe various types of knowledge representation techniques with the help of an example for each representation. [6]

3. a) Write a Prolog program to calculate gcd (greatest common divisor) of two numbers. [3]

b) Write a Prolog program for reversing a given list. [3]

c) Explain (with the help of examples) that how and when
i) ! (cut)
ii) !, fail
are used in Prolog to change the backtracking sequencing. [4]

a) Determine whether each of the following sets is unifiable. If yes, obtain a most general unifier.

i) w = { P(a,x,f(g(y))), P(z,f(z),f(u))}

ii) w= {Knows(Mother(y),y),Knows(Father(x),x)}

unifican fails

[3]

b) For a triangle ABC, it is given that the sum of the interior angles: <A + <B + <C = 180 degrees. Show by resolution theorem that the exterior angle is the sum of the opposite interior angles.

[7]

5. Develop a parse tree for the sentence "Ram saw the man in a park with a telescope" using the following rules.

S → NP VP

NP → N | DET N | NP PP

VP → V | V PP | V NP | V NP PP

PP → PREP NP

N → Ram | man | telescope | park

Verb → saw

DET → the | a

PREP → in | with

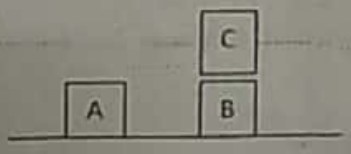
[10]

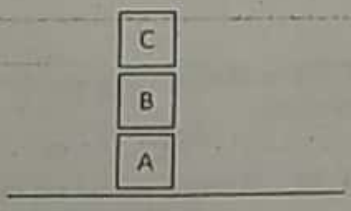
6.

a) Describe the differences and similarities between problem solving and planning.

[2]

b) Consider the following block world problem and solve it using goal stack planning





Start: ONTABLE (A) ∧
ONTABLE (B) ∧
ON(C, B) ∧
ARMEMPTY

goal: ON (C, B) ∧
ON (B, A)

[8]

M. Sc. (Computer Science)

MCS - 102 Artificial Intelligence

Semester I, Nov. / Dec. 2016

Attempt all questions.

Parts of a question must be answered together.

Time: 3 Hour

Total Marks: 70

1.

a. What is Rational Agent approach to Artificial Intelligence? List the similarities and differences between Turing Test approach and Rational Agent approach. [3]

b. For each of the following agents, develop a PEAS description of the task environment: [4]

(i) Internet book-shopping agent

(ii) Medical diagnosis system

c. When would best-first search be worse than simple breadth-first search? [1]

d. Let h' denote the estimate of h (the actual cost of getting from the current node to a final state node). Explain in what way the efficiency of A* algorithm and reaching of a goal state is affected if: [2]

(i) h' always underestimates h;

(ii) h' always overestimates h.

2.

a. Write an algorithm that will take as input two web page URLs and find a path of links from one to the other. What is an appropriate search strategy? Is bidirectional search a good idea? Could a search engine be used to implement a predecessor function? [5]

b. Backtracking is very useful for finding solutions in a prolog program. Why? Explain with the help of an example. [5]

3.

a. Determine whether each of the following sets is unifiable. If yes, obtain a most general unifier.

(i) w = { P(a,x,f(g(y))), P(z,f(z),f(u))}

(ii) w= {Knows(Father(y),y),Knows(x,x)} [6]

b. Write a Prolog program for reversing a given list. [4]

4.

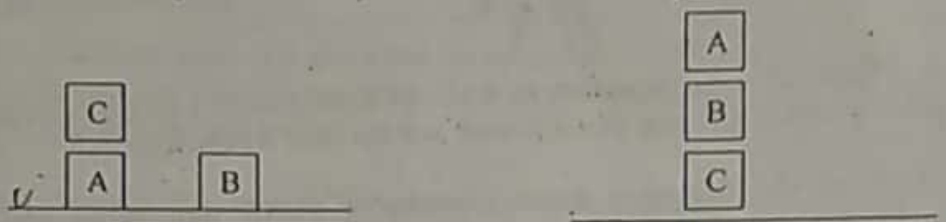
a. Represent the sentence "All Germans speak the same languages" in predicate calculus. Use speaks(x, l), meaning that person x speaks language l. [3]

b. Describe various types of knowledge representation techniques with the help of an example for each representation. [7]

5.

a. Describe the differences and similarities between problem solving and planning. [2]

b. Consider the following block world problem and solve it using goal stack planning



Start: ON(C, A) ∧
ONTABLE (A) ∧
ONTABLE (B) ∧
ARMEMPTY

goal: ON (A, B) ∧
ON (B, C)

[8]

6. Consider the following piece of knowledge:

Mary, Micky and John are members of Rotary club.
Every Rotary club member who is not a swimmer is a mountain climber.
Mountain climbers do not like rains.
Anyone who does not like water is not a swimmer.
Micky dislikes whatever Mary likes and likes whatever Mary dislikes.
Mary likes rain and water.

i. Represent this knowledge as predicate statements.
ii. Answer the query "Is there a member of Rotary club who is not a mountain climber but a swimmer" using resolution method.

[10]

7.

a. Show with the help of an example that the composition of substitution is not commutative. [2]

b. Develop a parse tree for the sentence "John liked the dog in the pen" using the following rules.

S → NP VP
NP → N | DET N | NP PP
VP → V | V PP | V NP | V NP PP
PP → PREP NP
N → John | dog | pen
V → liked
DET → the
PREP → in

[8]

(iii) Define a heuristic function

(iv) Show how the alpha-beta pruning can be used for this tree. (2+2+2+4)

2036

M.Sc. COMPUTER SCIENCE

(I Sem.)

MCS 102 - ARTIFICIAL INTELLIGENCE

(Admissions of 2004 and onwards)

Time : 2 Hours Maximum Marks : 40

(Write your Roll No. on the top immediately on receipt of this question paper.)

All questions are compulsory.

Parts of a question must be answered together

1. (a) What is Rational agent approach to AI ? How is it different than Turing test approach ? (2)

(b) You are explaining the problem of searching for a move in chess to a friend. Your friend notices that the algorithm needs to find the maximum of some function (i.e., the move that is best for you) and suggests that one should simply differentiate the function, set the result to zero, and solve. Explain why this will not work. (4)

(P.T.O.)

(b) For a triangle ABC, it is given that the sum of the interior angles: $\angle A + \angle B + \angle C = 180$ degrees. Show by resolution theorem that the exterior angle is the sum of the opposite interior angles. 6

3. (a) Differentiate between iterative and recursive functions in Prolog. Write iterative and recursive functions in Prolog to calculate factorial of a positive number n. 8

(b) Design a Prolog program unique(Bag,Set) that takes a Bag (a list that may contain duplicate elements) and returns a set (a list in which no elements are repeated). 5

4. Explain (with the help of examples) that how and when

(*i*) ! (cut)

(*ii*) fail

(*iii*) !, fail

are used in Prolog to change the backtracking sequencing. 6

2 sets Your Roll No. .....

0246 J

M. Sc. Computer Science / I Sem.

Paper – MCS. 102 : ARTIFICIAL INTELLIGENCE

(Admission of 2009 and onwards)

Time : 2 hours Maximum Marks : 50

(Write your Roll No. on the top of immediately on receipt of this question paper).
Attempt all questions. Parts of a question must be answered together.

1.

a) What is Turing test approach to Artificial Intelligence? List the similarities and differences between Turing Test approach and Rational Agent approach. [4]

b) Discuss and compare hill climbing and best-first search techniques [4]

2.

a) Using constraint satisfaction algorithm, solve the following cryptarithmetic problem :

```
  FAT
+FAT
-----
STOR
-----
```

[6]

When would best-first search be worse than simple breadth-first search? [2]

3. Consider the following piece of knowledge:
Mary, Micky and John are members of Rotary club.
Every Rotary club member who is not a swimmer is a mountain climber.
Mountain climbers do not like rains.
Anyone who does not like water is not a swimmer.
Micky dislikes whatever Mary likes and likes whatever Mary dislikes.
Mary likes rain and water.

a) Represent this knowledge as predicate statements.
b) Answer the query "Is there a member of Rotary club who is not a mountain climber but a swimmer" using resolution method. [8]

4. Determine whether each of the following sets is unifiable. If yes, obtain a most general unifier.

a) w = { P(a,x,f(g(y)), P(z,f(z),f(u))) }
b) w = {Knows(Father(y),y),Knows(x,x)} [6]

5. Backtracking is very useful for finding solutions in a prolog program. Why? Explain with the help of an example.

b) Write a Prolog program to find the factorial of a given number n. [4]

c) Write a Prolog program for reversing a given list. [4]

6.

a) Explain the knowledge representation using semantic net with the help of an example. [4]

b) What is an Expert System? Distinguish between a Knowledge based System and an Expert System? [4]

This question paper contains 2 printed pages Your Roll No.....

1847 A

M. Sc. COMPUTER SCIENCE / I Sem.

Paper MCS-102 : ARTIFICIAL INTELLIGENCE

(Admission of 2009 and onwards)

Time : 2 hours Maximum Marks : 50

(Write your Roll No. on the top of immediately on receipt of this question paper)
Attempt all questions. Parts of a question must be answered together.

1.

a) What is Rational Agent approach to Artificial Intelligence? List the similarities and differences between Turing Test approach and Rational Agent approach. [3]

b) Write an algorithm that will take as input two web page URLs and find a path of links from one to the other. What is an appropriate search strategy? Is bidirectional search a good idea? Could a search engine be used to implement a predecessor function? [5]

2.

a) For a triangle ABC, it is given that the sum of the interior angles: <A + <B + <C = 180 degrees. Show by resolution theorem that the exterior angle is the sum of the opposite interior angles. [6]

b) Determine whether each of the following sets is unifiable. If yes, obtain a most general unifier.

(i) w = {Q(a, x, f(x)), Q(a, x, y)}

(ii) w = {Q(x, y, z), Q(u, h(u, v), u)}

(iii) w = {Q(a), Q(b)} [6]

3.

a) Represent the sentence "All Germans speak the same languages" in predicate calculus. Use speaks(x, l), meaning that person x speaks language l. [2]

b) Describe various types of knowledge representation techniques with the help of an example for each representation. [6]

4.

a) Write a Prolog program for the fibonacci function defined below:

$$f(n) = \begin{cases} 1, & \text{for } n=0; \\ 1, & \text{for } n=1; \\ f(n-1) + f(n-2), & \text{for } n>1; \end{cases}$$

[3]

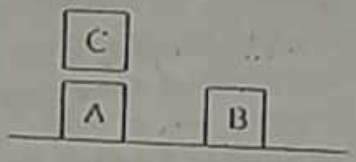
b) Write a Prolog program for obtaining a list after deleting all occurrence of a particular element from a given list. [3]

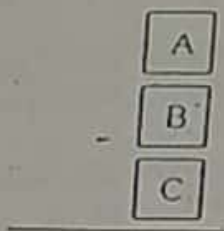
5.

a) Describe the differences and similarities between problem solving and planning.

100

b) Consider the following block world problem and solve it using goal stack planning [2]





Start: ON(C, A) ∧
ONTABLE (A) ∧
ONTABLE (B) ∧
ARMEMPTY

goal: ON (A, B) ∧
ON (B, C)

[6]

a) Distinguish between the State space search and Constraint satisfaction search.

b) Develop a parse tree for the sentence "Jack slept on the table" using the following rules. [2]

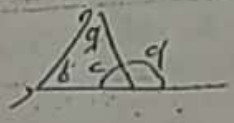
S → NP VP
NP → N
NP → DET N
VP → V PP
PP → PREP NP
N → jack | table
V → slept
DET → the
PREP → on

[6]

A+B+C = 180
A+B+C = 180 − C
P → Sum of two interior angles. Q → Exterior Angle.

∠C + ∠D = 180

∠D = 180 − ∠C



A + B = D

Equal (x, y)
Sum (x, y)
Sub (x, y)

This question paper contains 2 printed pages.

Your Roll No. _____

6436

M.Sc. Computer Science (I Sem.)

MCS.102

ARTIFICIAL INTELLIGENCE

(Admission of 2004 and onwards)

Time : 2 hours

Maximum Marks : 40

(Write your Roll No. on the top immediately on receipt of this question paper.)

All questions are compulsory.

Parts of a question must be answered together.

1. Using constraint satisfaction algorithm, solve the following cryptarithmetic problem:

```
  SEND
+ MORE
--------
 MONEY
--------
```

[7]

2. Describe various knowledge representation schemes with the help of examples. [8]

3. a) Define some good heuristic functions for the Tic-Tac-Toe problem. [1]

b) You are explaining the problem of searching for a move in chess to your friend. Your friend notices that the algorithm needs to find the maximum of some function (i.e., the move that is best for you) and suggests that one should simply differentiate the function, set the result to zero, and solve. Explain why this will not work. [6]

4. Determine whether the following set is unifiable. If yes, obtain a most general unifier.

$w = \{ P(a, x, f(g(y))), P(z, f(z), f(u)) \}$ [2]

Turn over

Assume the following facts

- Rama only likes easy courses.
- Engineering courses are hard.
- All the courses in the Science department are easy.
- PHY301 is a Science department course.

Convert these facts to predicate logic and use resolution to answer the question, "What course would Rama like?" [6]

5.

a) Write an iterative and a recursive Prolog programs to reverse a list. [4]

b) Write a Prolog program to find the sum of first n natural numbers. [3]

c) Write a Prolog program for obtaining a list after deleting all occurrence of a particular element from a given list. [3]

E(x) → any x is a easy course.

EC(x) – x is E.C

likes(x,y) → x likes y.

$\forall x$ likes (Rama, E(x))

$\forall x$ (EC(x) → E(x))

SC(x) → x is SC dept course

$\forall x$ (SC(x) → E(x))

SC (PHY301)

likes (Rama, ?)

likes(Rama, E(x)) — ¬EC(x) ∨ ¬E(x) — ¬SC(x) ∨ E(x) — SC(PHY)

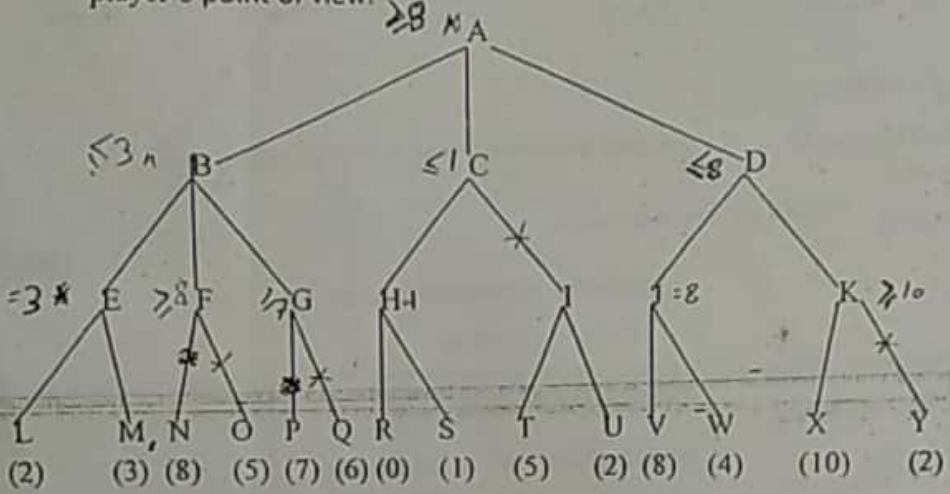
E(PHY)

¬EC(PHY)

7/

a) When would best-first search be worse than simple breadth-first search? [2]

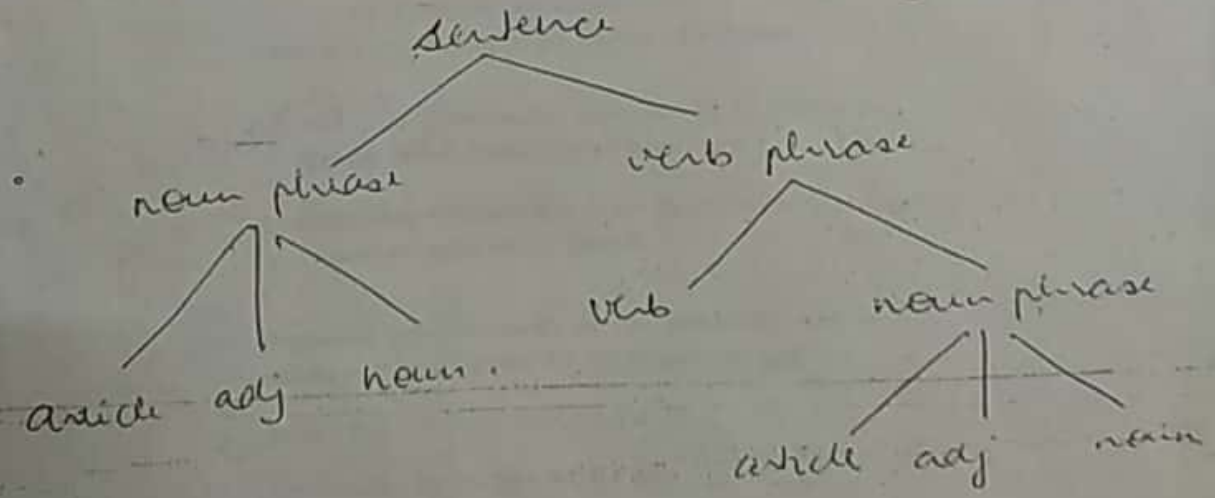
b) Consider the following game tree in which the static scores are all from the first player's point of view.



i) If the first player is a maximizing player then what move should be chosen under min-max procedure?

ii) What nodes would not be examined using α-β pruning procedure?

[8]



ing from the current node to a
of A* algorithm and reaching of

19 pages (6 pages + 13 marks)

goal(x) :- failure(x), !, fail.
goal(x).

fail/1 → called → failure of this rule.

writing / no backtrack can change this predicate.

[This question paper contains 3 printed pages.]

Your Roll No. 5.0513

1872

E

M.Sc. COMPUTER SCIENCE

(I Sem.)

Cut:
max(X,Y,Y) :- Y>=X, !.
max(X,Y,X).

MCS 102 – Artificial Intelligence

(Admissions of 2004 and onwards)

Time : 2 Hours

Maximum Marks : 40

(Write your Roll No. on the top immediately on receipt of this question paper.)

All questions are compulsory.

Parts of a question must be answered together.

1. (a) What is intelligent agent approach to AI. How is it different from rational agent approach ? (2)

(b) Distinguish between the State space search and Constraint satisfaction search. (2)

2. Determine whether each of the following sets is unifiable, if yes, obtain the most general unifier.

(a) W = {Q(a, x, f(x)), Q(a, y, y)}

(b) W = {Q(x, y, z), Q(u, f(u, v), u)}

(c) W = {Q(z), Q(b)}. (6)

P.T.O.

3. (a) Explain the knowledge representation using semantic net with the help of an example. (3)

(b) What are the main differences between scripts and frame structures? (3)

(c) What is an Expert System? How do you distinguish between a Knowledge based System and an Expert System? Describe the various conflict resolution strategies in Rule Based Expert Systems. (6)

4. (a) Explain (with the help of examples) that how and when

(i) ! (cut)

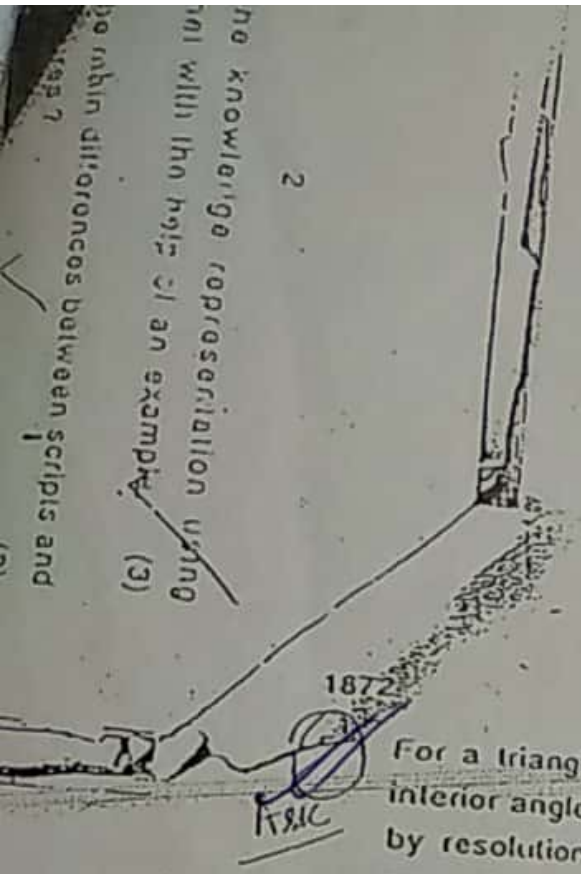
(ii) fail

(iii) !, fail

are used in Prolog to change the backtracking sequence. (3)

(b) Write a Prolog program to calculate gcd (greatest common divisor) of two numbers. (3)

(c) Write a Prolog program for obtaining a list after deleting all occurrences of a particular element from a given list. (3)



3

For a triangle ABC, it is given that the sum of the interior angles : $\angle A + \angle B + \angle C = 180$ degrees. Show by resolution theorem that the exterior angle is the sum of the opposite interior angles. (5)

6. (a) Is minimax procedure a depth-first or breadth-first procedure ? Justify your answer. (2)

(b) Where h' denotes the estimate of h (the actual cost of getting from the current node to a final state node). Explain in what way the efficiency of A* algorithm and reaching of a goal state is affected if :

(i) h' always underestimates h

(ii) h' always overestimates h (2)

G402 Your Roll No. 605174

M.Sc. COMPUTER SCIENCE

(I Sem.)

MCS 102— ARTIFICIAL INTELLIGENCE

(Admission of 2004 and onwards)

Time : 2 hours Maximum Marks : 40

(Write your Roll No. on the top immediately on receipt of this question paper.)

All questions are compulsory.

Parts of a question must be answered together.

1. (a) What is an Expert System? How do you distinguish between a Knowledge based System and an Expert System? 5

   (b) Why is it important that an expert system be able to explain the "why and how questions" related to a problem solving session? 4

2. (a) Determine whether each of the following sets is unifiable. If yes, obtain a most general unifier.

   (i) $w = \{Q(a, x, f(x)), Q(a, y, y)\}$

   (ii) $w = \{Q(x, y, z), Q(u, h(u, v), u)\}$

   (iii) $w = \{Q(a), Q(b)\}$. 6

P.T.O.