

[This question paper contains 7 printed pages.]

Your Roll No. 1903357007

Sr. No. of Question Paper : 1108

A

Unique Paper Code : 32341601

Name of the Paper : BHCS13: Artificial Intelligence

Name of the Course : B.Sc. (H) Computer Science

Semester : VI

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question 1 is compulsory.
3. Attempt any four questions from Question 2 to Question 8.
4. Parts of a question must be answered together.

1. (a) Describe the following terms : (4)

Q1 (i) Heuristic Function

Q2 (ii) Software Agent Eg.

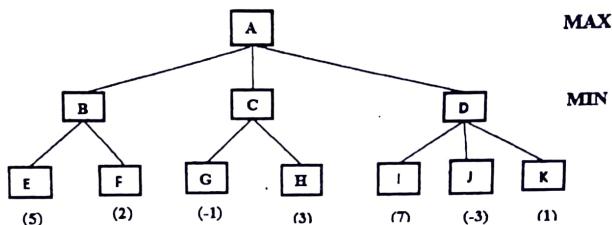
- Q3 (b) Write a context free grammar that can accept the sentence: "Ram hit the ball". (3)

P.T.O.

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- Q4 (c) In the following two-ply game tree, the terminal nodes show the utility values computed by the utility function. Use the Minimax algorithm to compute the utility values for other nodes in the given game tree. (2)



- Q5 (d) Find whether the following set is unifiable or not. If unifiable, find the most general unifier(m.g.u.).

$$w = \{\text{PARENTS}(x, \text{FATHER}(x), \text{MOTHER}(\text{bill})), \text{PARENTS}(\text{bill}, \text{FATHER}(\text{bill}), y)\} \quad (2)$$

- Q6 (e) Express the following sentence as conceptual dependency structure:

"Sohan gave Tina a box of chocolate" (2)

- Q7 (f) Write the conceptual graph and FOPL representation for the following sentence:

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3

"Every motorbike has a handle" (4)

- Q8 (g) Consider that $\text{append}(L1, L2, L3)$ is a function in Prolog, in which list L1 is contacted with L2 and the result is stored in L3. What would be the output of the following statement in Prolog?

?- $\text{append}([2,3,4], L, [2,3,4,a,b]).$ (2)

- Q9 (h) Find the meaning of the statement

$$(\sim P \vee Q) \wedge R \rightarrow S \vee (\sim R \wedge Q)$$

for the interpretation: P is true, Q is false, R is true, S is true. (2)

- Q10 (j) Transform the following sentence into disjunctive normal form:

$$\sim(P \vee \sim Q) \wedge (R \rightarrow S) \quad (3)$$

- Q11 (k) Determine whether the following sentence is satisfiable, contradictory or valid:

$$S \wedge (P \rightarrow Q) \rightarrow \sim P \quad (2)$$

- Q12 (l) Why should the heuristic function of A* algorithm always underestimate? Give reason, example.

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4

(3)

- Q13 (m) What is non-monotonic reasoning? Give an example. (3)

- Q14 (n) Prove that if A and B are independent events, $P(A|B) = P(A).$ (Note that A and B are independent if and only if $P(A \wedge B) = P(A)P(B)).$ (3)

- Q15 (a) Differentiate between partially observable and fully observable task environment of an agent. Give an example of each. (5)

- Q16 (b) Create a frame network for terrestrial motor vehicles (cars, trucks, motorcycles) and given one complete frame in detail for cars which includes the slots for the main component parts, their attributes, and relations between parts. (5)

- Q17 (a) What is closed world assumption? Give an example. (3)

- Q18 (b) Define Modus ponens rule. Elaborate using an example. (3)

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5

Q19 (c) Given formula S_1 and S_2 below, show that $Q(n)$ is a logical consequence of the two.

$$S_1: (\forall x)(P(x) \rightarrow Q(x)) \text{ and } S_2: P(a) \quad (4)$$

~~(a)~~ Create a script for shopping in a supermarket. (5)

Q2 (b) Joint probability $P(x_1, x_2, \dots, x_7)$ by inspection as a product of chain conditional probabilities is :

$$P(x_1, x_2, \dots, x_7) = P(x_7 | x_3) \cdot P(x_6 | x_5) \cdot P(x_5 | x_2 \\ x_1) \cdot P(x_4 | x_1 x_2) \cdot P(x_3) \cdot P(x_2 | x_1) \cdot P(x_1)$$

Draw the Bayesian belief network for the same. (5)

Q2 (a) Write a program in Prolog to compute the sum of elements of a list. (5)

Q23 (b) What are alpha and beta cutoffs? How alpha-beta pruning is used to improve the efficiency of Minimax procedure? (5)

6. (a) Compare and contrast Best-first search and Hill Climbing search. You can use example. (4)

6

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Q25 (b) What is a Recursive Transition Network (RTN)?
Give an example. (4)

Q26 (c) Give two limitations of propositional logic. (2)

~~Q1~~ (a) Consider the following axioms :

January

Clouds

Cold & Precipitation → Snow

January → Cold

Clouds → Precipitation

Convert them into clausal form and prove the truth of "Snow" using resolution. (5)

Q28 (b) Develop a parse tree for the sentence "The cruel man locked the dog in the house" using the following rules.

$\sqrt{S} \rightarrow NP\ VP$

NP → N

✓ NP → DET N

$$\text{VP} \rightarrow \text{V NP}$$

$\text{VP} \rightarrow \text{V PP}$

✓ VP → V NR RB

$\sqrt{\text{PP}} \rightarrow \text{PREP NP}$

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7

RTN)?

(4)

DET → ART ADJ

(2)

DET → ART

N → man | dog | house

V → locked

ART → the | a

ADJ → cruel

PREP → in

(5)

Q29 (a) Solve the following crypt arithmetic problem using constraint satisfaction.

truth

(5)

ODD

+ ODD

ruel

EVEN

(4)

Q30 (b) Describe the limitations of Hill Climbing Methods.
(3)

Q31 (c) Define the PEAS for vacuum cleaner agent.
(3)

[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2211

IC

Unique Paper Code : 32341601

Name of the Paper : Artificial Intelligence

Name of the Course : B.Sc. (H) Computer Science

Semester : VI

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory.
3. Attempt any 4 of questions from **Section B**.
4. Parts of a question must be answered together.

SECTION A

Q32 (a) What is a Horn clause? Give an example. (2)

Q33 (b) In the following expression, add parenthesis at appropriate places (as per operators precedence).

$$P \& Q \vee \sim R \& S \rightarrow \sim T \vee X \rightarrow Y \quad (2)$$

P.T.O.

2211

2

Q34 (c) How FOPL is better than Propositional logic? (2)

Q35 (d) Describe the following terms :

(i) Rationality

(ii) Software Agent

(4)

Q36 (e) Give the architecture of a problem solver with a Truth Maintenance System. (3)

Q37 (f) Write a Prolog program to calculate the length of a given list, L. (4)

Q38 (g) Describe the limitations of Hill climbing search. (3)

Q39 (h) Define the PEAS for taxi Driver Agent. (3)

Q40 (i) Define Heuristic Search technique. What is the role of a heuristic function? (4)

Q41 (j) Find whether the following set is unifiable or not? If unifiable, find most general unifier (m.g.u.).
 $\{S(x, \text{Ram}), S(y, \text{Sita})\}$ (2)

Q42 (k) Give the conceptual dependency representation for the following :

Ram gave Sita for a pencil. (2)

- Q43**(l) Develop a parse tree for the sentence "Raja slept on the sofa" using the following rules: (4)

$$S \rightarrow NP\ VP$$

$$NP \rightarrow N \mid DET\ N$$

$$VP \rightarrow V \mid PP$$

$$PP \rightarrow PREP\ NP$$

$$N \rightarrow Raja \mid sofa$$

$$V \rightarrow slept$$

$$DET \rightarrow the$$

$$PREP \rightarrow on$$

SECTION B

- Q44**(a) Define utility based agents and list their benefits. (5)

- Q45**(b) Elaborate on the additional capabilities of an Augmented Transition Network (ATN) as compared to a Recursive Transition Network (RTN). (2)

- Q46**(c) Draw an associative network for the following sentence :

Tweety is a Yellow bird that has wings and tail. (3)

p.T.O.

- Q47**(a) Write a script for watching a movie in a cinema hall. (5)

- Q48**(b) Find the probability of the event A when it is known that some event B occurred. From experiments, it has been determined that $P(B|A) = 0.84$, $P(A) = 0.2$, and $P(B) = 0.34$. (3)

- Q49**(c) Determine if the following sentence S is satisfiable, contradictory or valid.

S : $P \rightarrow Q \rightarrow \neg P$

- Q50**(a) Solve the crypt arithmetic problem :

TWO

+ TWO

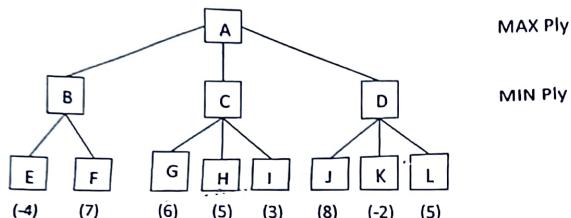
FOUR

(4)

- Q51**(b) Transform the following sentence into CNF :-

$(\sim A \& B) \vee (A \& \sim B) \& C$ (3)

- Q52**(c) Consider the following game tree with ply depth 2, in which the indicated scores are from the MAX player's point of view. What move should MAX choose, and why? (3)



Q53 (a) What do you understand by default reasoning in knowledge representation? (2)

Q54 (a) How a problem is solved using Mean-Ends Analysis. Explain in your own words. (2)

Q55 (c) Given the following information for a database:

A1. If x is on top of y , y supports x .

A2. If x is above y and they are touching each other, x is on top of y .

A3. A cup is above a book.

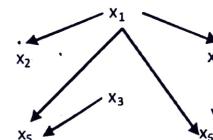
A4. A cup is touching a book.

(i) Translate the statements A1 through A4 into clausal form.

(ii) Show that the predicate supports (book, cup) is true using resolution. (6)

P.T.O.

(a) Write the joint distribution of x_1, x_2, x_3, x_4, x_5 , and x_6 as a product of the chain conditional probabilities for the following causal network : (3)



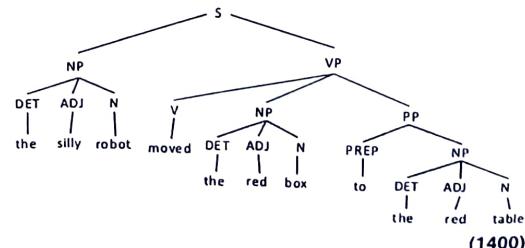
Q57 (b) What do you understand by alpha-beta cutoffs. Describe the method of alpha-beta pruning using these cutoffs with the help of an example. (4)

Q58 (c) Explain, why should the heuristic function of A* underestimate? (3)

Q59 (a) What is the use of "cut" utility in Prolog? (2)

Q60 (b) Describe Water-Jug problem and give its suitable state space representation. (4)

Q61 (c) Based on the context free grammar represented by the following parse tree, draw the corresponding Recursive Transition Network (RTN). (4)



This question paper contains 4 printed pages]

Roll No.

S. No. of Question Paper : 1491

Unique Paper Code : 2341701 F-7

Name of the Paper : Artificial Intelligence

Name of the Course : B.Tech. Computer Science

Semester : VII

Duration : 3 Hours Maximum Marks : 75

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

Question No. 1 is compulsory.

Attempt any four from Question Nos. 2 to 7.

Parts of a question must be answered together.

- Q6^a) Define an Agent, Agent Function and an Agent Program. 3
(b) Differentiate between knowledge-based systems and expert systems. 4

Q6^b) Why is state space representation important ? 2

Q6^c) Is minimax procedure Depth-first or Breadth-first ? Justify your answer. 2

Q6^e) Is the following set unifiable ? If yes, obtain a most general unifier for it : 3

$$W = \{P(A, B, B), P(x, y, z)\}$$

Q6^f) Obtain Skolem standard form for the following : 3

$$E = \exists X (P(f(x)) \wedge Q(x, f(a)))$$

P.T.O.

(2)

1491

- Q6^g) Explain utility function measure for an agent. 2
- Q6^h) Discuss special cases of hill climbing : Local Maximum, Plateau and Ridge. 3
- Q6ⁱ) Express the following sentences as conceptual dependency structures : 6
- (i) Bill is a programmer
(ii) Joe gave Sue a flower.
- Q7^j) What are the main differences between scripts and frame structure ? 3
- Q7^k) A 3-feet tall monkey is in a room, where some bananas are suspended from 8-feet high ceiling. The room contains two stackable, movable and climbable 3-feet high crates. Give the initial state, goal state, successor function and cost function for getting the bananas. 4
- Q7^l) Let h' denote the estimate of h (the actual cost of traversing 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 : 6
- (i) h' always underestimates h.
(ii) h' always overestimates h.
- Q7^m) Consider a state space where the start space is number 1, and the successor function for a state n returns two states numbered 2n and 2n + 1 : 4
- (i) Draw the portion of state space for states 1 to 15.
(ii) Suppose the goal state is 11. List the order in which nodes will be visited for breadth — first search.
- Q7ⁿ) Explain Cut, Fail and Cut-fail statements in PROLOG. 6
- Q7^o) Write a PROLOG program to find GCD of two numbers. 4

(3)

1491

- Q8(d) Explain Turing Test approach to AI. How is Turing Test approach different from Rational Agent approach ? 6

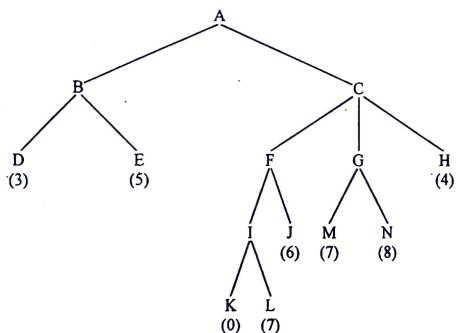
- Q8(e) Develop PEAS description of the task environment for — Internet book-shopping agent. 4

- Q8(f) Using constraint satisfaction algorithm, solve the following crypt arithmetic problem : 6

$$\begin{array}{r} \text{O D D} \\ + \text{O D D} \\ \hline \text{E V E N} \end{array}$$

Q8(g) A game tree is as follows :

4



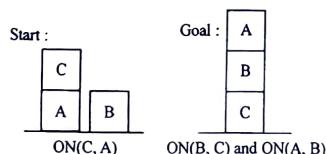
Which nodes would not be examined using alpha-beta pruning procedure ? Write a stepwise explanation.

- Q8(h) Discuss the differences and similarities between problem solving and planning. 5

(4)

1491

- Q8(i) Consider the following block world problem and solve it using goal stack planning : 5



- Q8(j) Consider the following piece of knowledge :

6

Some patients like all doctors.

No patient like any quack.

- (i) Represent this knowledge as predicate statements.

- (ii) Prove the query "no doctor is a quack" is correct, using resolution method.

- Q8(k) Derive a parse tree for the sentence "Mary slept on the chair" using the following rules : 4

S → NP VP

NP → N

NP → DET N

VP → V PP

PP → PERT NP

N → Mary/Chair

V → Slept

DET → the

PERT → on

This question paper contains 5-printed pages.]

1807

Your Roll No.

B.Sc. (H) Computer Science / VI Sem. A
Paper - 605 (i) : ARTIFICIAL INTELLIGENCE
(Admissions of 2001 and onwards)

Time : 3 Hours

Maximum Marks : 75

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

Attempt all questions.

All parts of a question must be answered together.

- Q84 (a) What do you understand by heuristic search? How heuristics search is used in AI problem solving. 3
- Q85 (b) Give an example where Best First search is better than Breadth search. 4
- Q85 (c) Why is it important that an expert system be able to explain the why and how questions related to a problem solving session? 4
- Q85 (d) What is unsupervised learning? Describe how supervised learning can be used for pattern recognition. 4

2. (a) Find the errors in the following LISP statements and give the output in case there is no error.

(i) $\rightarrow (\text{listp } 'a)$

(ii) $\rightarrow (\text{lessp } 6\ 7\ 2\ 9\ 3)$

(iii) $\rightarrow (\text{append } 'a\ '(e\ g))$

3

- (b) Write an iterative function in LISP name SUM-
ALL using 'do' statement that takes an integer
N as argument and returns the sum of the integers
from 1 to N. 4

Q86 Prove that if A and B are two independent events
then $P(A \cap B) = P(A) \cdot P(B)$. 3

- Q87 (a) Determine whether each of the following sentence
is : 4

(i) Satisfiable

(ii) Contradictory

(iii) Valid

S1: $P \rightarrow Q \rightarrow \neg P$

S2: $(P \& Q) \vee \neg (P \& Q)$

S3: $(P \vee Q) \rightarrow (P \& Q)$

S4: $P \vee Q \& \neg P \vee \neg Q \& P$

Q8(b) Comment on the following statements giving justifications for your answers: 3+3

- (i) A* always guarantee an optimal solution for a minimization problem.
- (ii) AO* algorithm ensures that it does not get stuck into an infinite loop while generating successors in a graph.

Q89(a) Solve the given crypt-arithmetic problem using constraint satisfaction. 5

$$\begin{array}{r} \text{TWO} \\ + \text{TWO} \\ \hline \text{FOUR} \end{array}$$

Q90(b) Explain any two situations where a Hill climbing algorithm may fail to find a solution. How can we deal with these situations? 5

Q91(a) Transform the following formula to clausal form:
 $\forall x \forall y (\exists z P(x, z) \& P(y, z)) \rightarrow \exists u Q(x, y, u)$ 3

Q92(b) Translate the following sentences into clausal form and use resolution technique to draw the required inference. 5

S1: Some patients like all doctors.

S2: No patient likes any quack.

Conclusion: Therefore, no doctor is a quack.

Q93(c) Given the joint distribution of x_1, x_2, x_3, x_4, x_5 , and x_6 as a product of the chain conditional probabilities as:

$$P(x_1, \dots, x_6) = p(x_5 | x_1, x_2, x_3) p(x_6 | x_1, x_4) \\ p(x_4 | x_1) p(x_2 | x_1) p(x_3) p(x_1)$$

Provide the causal network to represent the above joint distribution. 2

Q94(a) Transform the following sentences into conceptual graph: 2+2

- (i) Sam gave Mary a box of candy.
- (ii) Charlie drove the pickup fast.

Q95(b) Create a movie script using the script syntax. The script must be named and specify the track, roles, entry conditions, props, different scenes and the results. The script should describe the scenes for movie ticket purchase and entry of the buyer in the movie hall. 6

7. (a) Consider the following assertions written in Modal logic for the given knowledge base : 4

S1 : (Sam is a man)

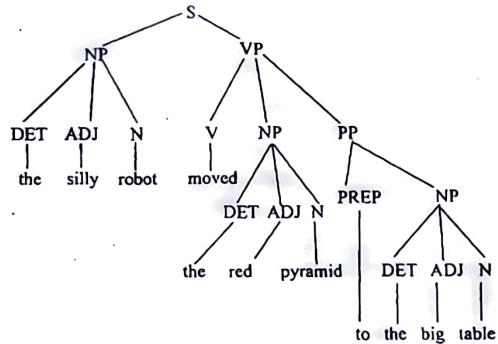
S2 : M(Sam is a child)

S3 : L[(Sam is a child) \rightarrow L \neg (Sam is a child)]

S4 : L[(Sam is a man) \rightarrow (Sam is a child)]

Use Modal logic axioms and prove that : \neg (Sam is a child).

- Q9(b) Given the following parse tree, write down the corresponding context free grammar. 2+4



Also draw an Augmented Transition Network to implement the grammar for the parse tree.

This question paper contains 4-2 printed pages)

1 2 1

1959

1959

Your Roll No.

B.Sc. (Hons.) Computer Science/VI Sem. C

Paper 605 (i) - ARTIFICIAL INTELLIGENCE

(Admissions of 2001 to 2010)

Time : 3 Hours

Maximum Marks : 75

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

All questions in Section A are compulsory.

Attempt any four questions in Section B.

Section A

1. (a) When do you call a machine intelligent ? Name the criteria used for determining whether a machine is intelligent or not ? 1+2

- (b) Explain the physical symbol system hypothesis ? 3

D92
Differentiate Depth first search and Best first search with the help of an example. 5

P.T.O.

D98

Express the sentences given below into conceptual dependency structure. 4

(i) Sushil ate soup with a spoon

(ii) Rita gave Sita a bunch of flowers.

2. (a) Write the output of the following LISP statements : 4

(i) (cadadr '(a (b c) d))

(ii) (reverse '(a b c (d)) e f))

(iii) (member 'c '(a (b (c))d e))

(iv) (length 22 44 17 9 20))

D99b

Transform the following into CNF : 3

(i) P v (~ P & Q & R)

(ii) (~ P & Q) v (P & ~ Q) & S

D100

Draw a pictorial definition for the linguistic variable AGE giving your own subjective values for AGE variables and their values. 3

3. (a) Write a recursive LISP function to find the n th term of a Fibonacci series, where the number n is to be passed as an argument to a function. 4

- (b) Give the cons-cell representation of the following list. 6

(a) (b) (c) (d) (e) (f) g h i (j) .

Section B

- Q101 (a) Describe the various problems associated with Hill climbing method and explain them. 6

- (b) Write a short note on Neural Network Architecture. 4

- Q102 (a) How many types of non-deductive inference are there ? Explain. 4

- Q103 (b) Give an example of non-monotonic reasoning and describe it also. 3

- Q104 (b) Develop a parse tree for the sentence "Raja slept on the sofa". 3

P.T.O.

- Q105 Write a script for going to a movie. 4

- Q106 Describe the admissibility condition for the A* algorithm. In what situations A* will give an optimal solution ?

- Give appropriate examples. 2+2=2

- Q107 Consider the following axioms : 4+3

- (i) Every boy or girl is a child.
- (ii) Every child gets a doll or a train or a lump of coal.
- (iii) No body gets any doll.
- (iv) No child who is good gets any lump of coal.
- (v) (Conclusion) If no child gets a train, then no boy is good.

Prove that given conclusion using resolution technique.

Q108

Define the sentences S1, S2 and S3. S1 = P. S2 = Q and

S3 = P \rightarrow Q. Determine the probabilistic truth values of

S1, S2 and S3 when it is known that probabilities of the

possible words are given by :

3

$$P(W1) = 1.4, P(W2) = 1.8,$$

$$P(W3) = 1.8 \text{ and } P(W4) = 1.2.$$

Q109(a)

Define a production system. What type of production

system is appropriate for designing a chemical synthesis

problem and why ?

2+3

Q110

Transform the following into clausal form :

5

$$\exists x \forall y (\forall z P(f(x), y, z)) \rightarrow (\exists u Q(x, u) \& \exists v R(y, v)).$$

Q 9

Write short notes on the following :

10

Q111 Uninformed Search*Q112* Heuristic Search*Q113* Mean End Analysis*Q114* Resolution Principle.

[This question paper contains 8 printed pages]

Your Roll No. :

Sl. No. of Q. Paper : 6515 **HC**

Unique Paper Code : 32341601

Name of the Course : **B.Sc.(Hons.) Computer
Science**

Name of the Paper : Artificial Intelligence

Semester : VI

Time : 3 Hours **Maximum Marks : 75**

Instructions for Candidates :

- Write your Roll No. on the top immediately on receipt of this question paper.
- Section A is compulsory.
- Attempt any four of questions from Section B.
- Parts of a question must be answered together.

P.T.O.

SECTION A

1. (a) Describe the following : 4

Q11^a Agent Function

Q11^b Closed World Assumption

Q11^c In what type of reasoning existing rules can be retracted ? Explain, whether a rule can be retracted in FOPL. 2

Q11^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 h' always overestimates h. 2

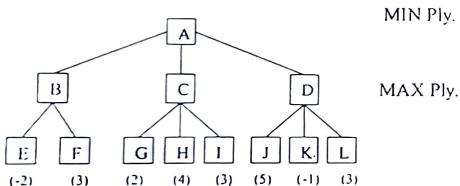
Q11^e (d) Differentiate between breadth first search and best first search. 3

Q11^f (e) Explain uses of Cut and Fail predicates in PROLOG. 3

Q11^g (f) Find the meaning of the statement $(\neg P \vee Q) \& R \rightarrow S \vee (\neg R \vee Q)$ 2
for the following interpretation : P is true, Q is true, R is false, S is true. 2

Q12(g) Transform the following sentence into disjunctive normal form : 2
 $\neg(P \vee \neg Q) \wedge (R \rightarrow S)$

Q12(b) Consider the following game tree with ply. depth 2, in which the indicated scores are from the MIN player's point of view. What move should MIN choose, and why ? 3



Q12(d) Express the following sentences as conceptual dependency structures : 4

- (i) Bill is a programmer
- (ii) Joe gave Sue a flower.

Q12(e) Determine whether set is unifiable ? If yes, obtain a most general unifier. 2

$$W = \{P(A, B, B), P(x, y, z)\}$$

Q12(f) Differentiate between a fully observable and partially observable environment. 4

Q12(g) Give an example of each of the four types 0, 1, 2 and 3 for Chomsky's hierarchy of grammars. 4

SECTION B

Q12(h) Write a PROLOG program to reverse a list. 4

Q12(i) Describe the working of a Learning Agent. 3

Q13(c) Prove that if events A and B are independent, $P(B|A) = P(B)$. 3

Q13(a) Using constraint satisfaction algorithm, solve the following crypt arithmetic problem. 5

$$\begin{array}{r}
 \text{O} \text{ D} \text{ D} \\
 \text{O} \text{ D} \text{ D} \\
 \hline
 \text{E} \text{ V} \text{ E} \text{ N}
 \end{array}$$

6515

Q13^a Discuss, based on the alpha value of a MAX player and beta value of a MIN player, when the search is discontinued in the MINIMAX procedure using alpha-beta pruning. Explain, using an example.

5

Q13^b Derive a parse tree for the sentence

3

" Mary slept on the chair "

Using the following rules :

$S \rightarrow NP VP$

$NP \rightarrow N$

$NP \rightarrow DET N$

$VP \rightarrow V PP$

$PP \rightarrow PREP NP$

$N \rightarrow Mary / Chair$

$V \rightarrow Slept$

$DET \rightarrow the$

$PREP \rightarrow on$

Q13^c Joint probability $P(x_1, x_2, \dots, x_8)$ by inspection as a product of chain conditional probabilities is:

$$P(x_1, x_2, \dots, x_7) = (P(x_7 | x_5, x_6) P(x_6 | x_3, x_4) \\ P(x_5 | x_4) P(x_4 | x_2) P(x_3 | x_2) P(x_2 | x_1) P(x_1))$$

Draw the causal network for the same.

4

5

P.T.O.

6515

Q13^c (c) What should be the features of a good performance for a rational agent ?

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Q13^d (d) Based on the following statements :

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i. Whoever can read is literate

ii. Dolphins are not literate

iii. Some dolphins are intelligent also.

iv. Donald is a dolphin.

Using resolution to prove that "some intelligent beings cannot read".

Q13^e (e) Evaluate truth value of expression

$$E = \exists X (P(f(x)) \wedge Q(x, f(a)))$$

With given domain D = {1,2}; assignment for a=1; assignment for f are : f(1) = 2,

$$f(2) = 1.$$

Q13^f (f) Write the conceptual graph and FOPL representation for the following sentence :

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"Every cycle has pedals".

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Q139

- (b) Express the following concepts as an associative network structure with interconnected nodes and labeled arcs.

Company ABC is a software development company. Three departments within the company are Sales, Administration and Programming. Joe is the manager of Programming. Bill and Sue are programmers. Sue is married to Sam. Sam is editor for Prentice Hall. They have three children, and they live on Elm street. Sue wears glasses and is five feet four inches tall.

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Q40

- 7 (a) What are the similarities and differences between Conceptual Graph (CG) and Conceptual Dependency (CD) representation structures ?

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Q140

- (b) Explain the difference between a Recursive Transition Network and Augmented Transition Network.

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Q142

- (c) You are given two jugs of capacity 4-gallon and 3-gallon respectively. Neither has any measuring marker on it. There is a pump that can be used to fill the jugs with water. How can you get exactly 2 gallons of water into the 4-gallon jug ? Write down solution by showing all intermediate states.

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[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 6094

D Your Roll No.....

Unique Paper Code : 234607

Name of the Course : B.Sc. (H) Computer Science

Name of the Paper : Artificial Intelligence (CSHT-616) (ii)

Semester : VI

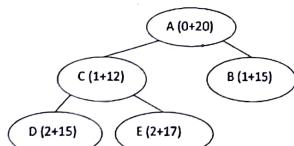
Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. 1 is compulsory.
3. Attempt any 4 of Question Nos. 2 to 7.
4. Parts of a question must be answered together.

Q143 (a) Determine the next node which will be expanded next in Figure below using Best First Search. (3)



Q144 (b) Discuss the scope and limitations of knowledge representation using Propositional Logic. (4)

Q145 (c) Prove that if events A and B are independent, $P(A|B) = P(A)$. (3)

Q146 (d) Determine if the following sentence S is satisfiable, contradictory or valid.
S : $(P \& Q) \rightarrow R \vee \neg Q$ (3)

Q147

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Q148

(a) Define a rational agent. What do you understand by agent autonomy ? (4)

Q149

(b) Transform the sentence : $(P \rightarrow Q) \rightarrow R$ into conjunctive normal form. (3)

Q150

(a) Differentiate between monotonic reasoning and non-monotonic reasoning. (4)

Q151

(b) Represent the sentence "Ram gave a book to Sohan" using Conceptual Dependency structure. (3)

Q152

Develop a parse tree for the sentence: Jack slept on the table: using the following rules.

S	\rightarrow	NP VP
NP	\rightarrow	N DET N
VP	\rightarrow	V PP
PP	\rightarrow	PREP NP
N	\rightarrow	jack table
V	\rightarrow	slept
DET	\rightarrow	the
PREP	\rightarrow	on

(4)

Q153

(a) Describe how alpha-beta pruning improves the searching procedure in a MIN-MAX game. (4)

Q154

(a) What do you understand by underestimation and overestimation of a heuristic function ? Under what condition A* gives optimal solution. (6)

Q155

(b) What are the limitations of Hill Climbing search. (4)

Q156

Sam, Clyde and Oscar are elephants. We know the following facts about them :

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A1 : Sam is pink.

A2 : Clyde is gray and likes Oscar.

A3 : Oscar is either pink or gray (but not both). *and likes both*.

(i) Translate statements A1 to A3 into clausal form. (3)

(ii) Use resolution to prove that "A gray elephant likes a pink elephant". (4)

Q156 (i) Describe the properties of Chomsky's type 2 grammar. (3)

Q157 Write the Conceptual Graph and FOPL representation for the following sentence :

"Every bank has a locker" (4)

Q158 Given formulas S₁ and S₂ below, show that Q(a) is a logical consequence of the two.S1: $(\forall x((P(x) \rightarrow (Q(x)))$ S2: P(a) (4)

Q159 Define a well formed formula (wff). (2)

Q160 Differentiate between Deterministic and Stochastic task environments. Give example. (5)

Q161 Joint probability P(x₁, x₂, ..., x_n) by inspection as a product of chain conditional probabilities is :

$$P(x_1, x_2, \dots, x_n) = P(x_1|x_0, x_2) P(x_2|x_1, x_3) P(x_3|x_2, x_4) P(x_4|x_3) P(x_5|x_4) P(x_6|x_5) P(x_7|x_6) P(x_8|x_7)$$

Draw the causal network for the same. (5)

Q162 Create a frame network for terrestrial motor vehicles (cars, trucks, motorcycles) and give one complete frame in details for cars which include the slots for the main component parts, their attributes, and relations between parts. (5)

Q163 What is a Recursive Transition Network ? Explain, with an example. (5)

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Q164 Transform the sentence : $\sim(P \& Q) \& (P \vee Q)$ into disjunctive normal form. (3)

Q165 Which one among Best First Search or A* is better to search an optimal path to a node, and why ? (4)

Q166 Describe, how a sentence is represented using Case Grammar. (3)

[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 859

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Your Roll No.: 201270020

Unique Paper Code : 234607

Name of the Course : B.Sc. (H) Computer Science

Name of the Paper : Artificial Intelligence (CSHT-616)(ii)

Semester : VI

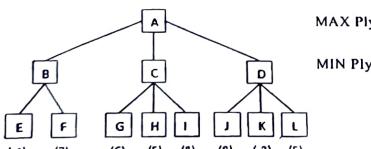
Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. 1 (one) is compulsory.
3. Attempt any 4 of questions Nos. 2 to 7.
4. Parts of a question must be answered together.

Q167 Consider the following game tree with ply depth 2, in which the indicated scores are from the MAX player's point of view. What move should MAX choose, and why ? (3)



Q168 Define Heuristic Search technique. What is the role of a heuristic function ? (4)

Q169 Transform the sentence : $(P \vee (\neg P \& Q \& S))$ into conjunctive normal form. (3)

Q170 What is non-monotonic reasoning ? Explain with a suitable example. (1+2)

P.T.O.

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Q171 Define in your words :

(i) Artificial Intelligence

(ii) Agent

(iii) Rationality

(3)

Q172 What are the similarities and differences between Conceptual Graph (CG) and Conceptual Dependency (CD) representation structures ? (5)

Q173 Write a context free grammar that can accept the sentence: "Ram hit the ball". (3)

Q174 Which searching technique among Breadth First Search and Hill Climbing search is more intelligent, and why ? (3)

Q175 Elaborate on the additional capabilities of an Augmented Transition Network (ATN) as compared to a Recursive Transition Network (RTN). (4)

Q176 Compare and contrast propositional and predicate logic. (4)

Q177 Find the probability of the event A when it is known that some event B occurred. From experiments it has been determined that $P(B|A) = 0.84$, $P(A) = 0.2$, and $P(B) = 0.34$. (4)

Q178 (a) Create a script for going to a movie. (6)

Q179 (b) Define utility based agents and list their benefits. (5)

Q180 Define alpha and beta cutoffs. Explain how these are used in minimizing search space in MINIMAX procedure ? (5)

Q181 Consider the following Prolog Program and answer (a) & (b) :

```
invented(edison,lightbulb).  
invented(colmerauer,prolog).  
iq(einstein,210).  
iq(edison,160).
```

```

iq(waldorf,90).
genius(Person) :-
    iq(Person,IQ),
    IQ > 150.
genius(Person) :-
    invented(Person,...).

```

Q182 For the query `?-genius(A)`, what is the first answer that Prolog will return? (2)

Q183 Define a predicate "smart_invention" (given as under) which returns inventions that are invented by people with an IQ of 160 or more.

```

smart_invention(Invention) :-
    _____ ? (3)

```

Q184 What do you understand by Closed Word Assumption in knowledge representation? (2)

Q185 Represent the sentence "John went from Delhi to Shimla" using Conceptual Dependency structure. (3)

Q186 Give one example for each of 0, 1, 2 and 3 type of Grammars by Chomsky. (4)

Q187 Write a short note on the following :

- (i) Default Reasoning (3)
- (ii) Abductive Inference (3)

Q188 Find the meaning of the statement

$$(\neg P \vee Q) \wedge R \rightarrow S \vee (\neg R \vee Q)$$

for the following interpretation : P is true, Q is true, R is false, S is true. (3)

Q189 (i) Transform the following sentence into disjunctive normal form :

$$\sim(P \vee \neg Q) \wedge (R \rightarrow S) \quad (3)$$

Q190 (ii) Explain, why should the heuristic function in A* should always underestimate ? (4)

Q191 (iii) After a coin is tossed, consider the following statements and their equivalent symbolic form in propositional calculus :

Statement	Symbolic Form
It comes either Head or Tail	H V T
If it is Heads, I win	H → IW
If it is Tails, you lose	T → YL
If you lose, I win	YL → IW

Based on the above information :

- (i) Convert these statements into clausal form, and (2)
- (ii) Using resolution prove that I win. (4)

Q192 Based on the context free grammar represented by the following parse tree, draw the corresponding Recursive Transition Network (RTN). (4)

