BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE **SEMESTER : VII/ADD**
BRANCH: IT **SESSION : MO/18**

SUBJECT: IT7025 ARTIFICIAL INTELLIGENCE

TIME: 3.00 HOURS **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) (I) State the relationship between the terms "intelligence" and "knowledge". [1+1]
(II) Define artificial Intelligence and write any two applications of Artificial Intelligence.

Q.1(b) (I) Discuss the following terms: [3+1]
a) belief b) hypotheses c) Heuristic knowledge
(II) What is a Turing test? Why is it done?

Q.1(c) (I) What is the use of inference engine? Discuss the importance of knowledge base system. [3+3]
(II) Briefly describe the meaning of knowledge representation and knowledge acquisition.

Q.2(a) (I) Describe the LISP manipulation functions: append and reverse with examples. [1+2]
(II) What is 'lambda function'? Write a LISP program by using a 'lambda function' to evaluate the roots of the quadratic equation: $ax^2 + bx + c = 0$ using the formula: $x = (- b \pm \sqrt{} (b^2 - 4ac))/2a$.

Q.2(b) (I) The N^{th} triangular number is defined to be $1 + 2 + 3 + ... + N$. The triangle numbers are given by the following explicit formulas: $T_n = 1 + 2 + 3 + ... + N = n(n+1)/2$. [2+2]
Alternatively, we could give a recursive definition of triangular number as follows:

$$T(n) = 1 \quad \text{if } n = 1$$

$$T(n) = n + T(n-1) \quad \text{if } n > 1$$

Use the recursive definition to help you implement a linearly recursive function (triangular *N*) that returns the N^{th} triangular number. Enter your function definition into a text file. Then load it into LISP. Trace the execution of (triangular 6).
(II) Implement 'bubble sort' in LISP using 'do construct' and 'aref function'.

Q.2(c) Implement following PROLOG programs: [2x2.5]
(I)Write PROLOG predicate to compute all possible permutations of a given list. The following implementation uses the built-in predicate select, which takes a list as its second argument and matches the first argument with an element from that list. The variable in the third argument position will then be matched with the rest of the list after having removed the chosen element.

Example: ?- permutation([1, 2, 3], X).
X = [1, 2, 3];
X = [1, 3, 2];
X = [2, 1, 3];
X = [2, 3, 1];
X = [3, 1, 2];
X = [3, 2, 1];

(II) Implement PROLOG program by using predicate divisors to compute the list of all divisors for a given natural number.

Example: ?- divisors(30, X).
X = [1, 2, 3, 5, 6, 10, 15, 30].

Make sure your program doesn't give any wrong alternative solutions and doesn't fall into an infinite loop when the user presses the semicolon key.

Q.3(a) Define logic? Compare Propositional Logic and Predicate Logic. [1+1]

Q.3(b) (I) Differentiate the terms: (a) Abductive Inference b) Inductive inference (c) Deductive inference. [3+2]
(II) Convert the following wff (well-formed formula) into Clausal form:

$$\forall xy\ (\exists z\ P(x, z)\ \&\ P(y,z)) \rightarrow \exists u\ Q(x, y, u)$$

PTO

Q.3(c) Consider the following axioms: [5]

1. Anyone who buys carrots by the bushel owns either a rabbit or a grocery store.
2. Every dog chases some rabbit.
3. Mary buys carrots by the bushel.
4. Anyone who owns a rabbit hates anything that chases any rabbit.
5. John owns a dog.
6. Someone who hates something owned by another person will not date that person.
7. (Conclusion) If Mary does not own a grocery store, she will not date John.

Represent these clauses in predicate calculus, using only those predicates which are necessary. For example, you need not represent `person', and phrases such as `who buys carrots by the bushel' may be represented by a single predicate. Negate the conclusion and convert to clause form. Prove the unsatisfiability of the resulting set of clauses by resolution and unification.

Q.4(a) Compare non-monotonic and statistical reasoning with examples. [2]

Q.4(b) What is 'Truth maintenance system (TMS)'? Consider the following statements: [4]

(i) Most thing do not fly.
(ii) Most bird do fly, unless they are too young or dead or have a broken wing.
(iii) Penguins and ostriches do not fly.
(iv) Magical ostriches fly.
(v) Tweety is a bird.
(vi) Chirpy is either a penguin or an ostrich.
(vii) Feathers is a magical ostrich.

How TMS will give the answer of the following: 'Does feathers fly?' with the help of above lists.

Q.4(c) Write the short notes on following topics: [2x3]

(I) Default reasoning and Close world assumption.
(II) Dempster-Shafer Theory for solving uncertainty.

Q.5(a) Explain how 'semantic network' is used for knowledge representation. [2]

Q.5(b) (I) Transform the followings into conceptual graph. [3+1]

(a) 'Tom believes Mary wants to marry a sailor'
(b) $\forall x$ HASWINGS(x) & LAYSEGGS(x) $\rightarrow$ISBIRD(x)

(II) Express the following sentence as conceptual dependency structure.

'Charlie drove the pickup fast'.

Q.5(c) (I) What are the differences between script and frame structure? [2+4]

(II) Write a SCRIPT for 'writing an examination' and explain.

Q.6(a) (I) State the advantage of heuristic search. [1.5+1.5]

(II) What are the problems of Hill climbing algorithm- explain.

Q.6(b) (I) Compare and contrast Depth first search and Breadth First Search illustrating the advantages and disadvantages of each. [2+2]

(II) Explain the 8-Puzzle problem along with its state space tree representation.

Example of 8-Puzzle problem:

2	8	3
1	6	4
7		5

Initial State

1	2	3
8		4
7	6	5

Goal state

The 8-Puzzle involves moving the tiles on the board above into a configuration. The black square on the board represents a space. The player can move a tile into the space, freeing that position for another tile to be moved into and so on.

For example, given the initial state above we may want the tiles to be moved so that the following goal state may be attained.

Q.6(c) What is best first search and how it is different from A* search. Explain A* search algorithm with an example. [5]

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Q.7(a)	Explain the following measures for matching: a) Probabilistic Measures b) Qualitative measures	[2x2.5]
Q.7(b)	Write down the procedures for matching two structure like: (a) Matching substrings and (b) Matching graphs.	[2+2]
Q.7(c)	Describe different knowledge indexing and retrieval techniques to select, search, test and retrieve a minimal amount of requisite knowledge from large body of knowledge in knowledge base systems.	[4]

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