Unit -I

Artificial Intelligence :-

Def:- Artificial Intelligence is the study of computer that make it possible to preceive, region & act.

A.I. is the study of how to make computer do things which, at the moments people do better.

A.I. is the study and creation of the system that think like human i.e. machines with mind. In this we can associate the activities of m/c with those of human thinking like decision making, problem solving and learning etc.

A.I. is the study & creation of system that act like human i.e. the art of creating m/c's that perform function that require intelligence when performed by people.

Fields of Application of A.I.

Their are a number of applications of A.I., A few of them are :-

1) Autonomus planning & scheduling :-

Remote agent program control the scheduling of operation for a space craft. Remote gents generated programs (plans) for high level goals specified from ground and it monitored the operation of the space craft as the plans are executed, & detecting, diagnosis and recovery from the problems as they occurs.

2) Game Plane :-

IBM's 'Deep Blue' became the fisst computes program to defeat the world champion in a chess match when it beated Gary Kasparov by a score of 3.5 to 2.5 in a exhibition match.

3) Autonomus Control :-

ALVINN computes vision system was trained to steas a car to keep it following a lane. It navigate across the United States for 2850 miles, It was in control of steering the vehicle 98% of time. NAVLAB has video camera that transmit

read maps or images to ALVINN, which then computes best direction to steer, based on experience from training runs.

4) Diagnosis

Medical diagnosis program based on probabilistic analysis have been able to perform at level of an expert physician in several areas of medicine.

5) Robotics:-

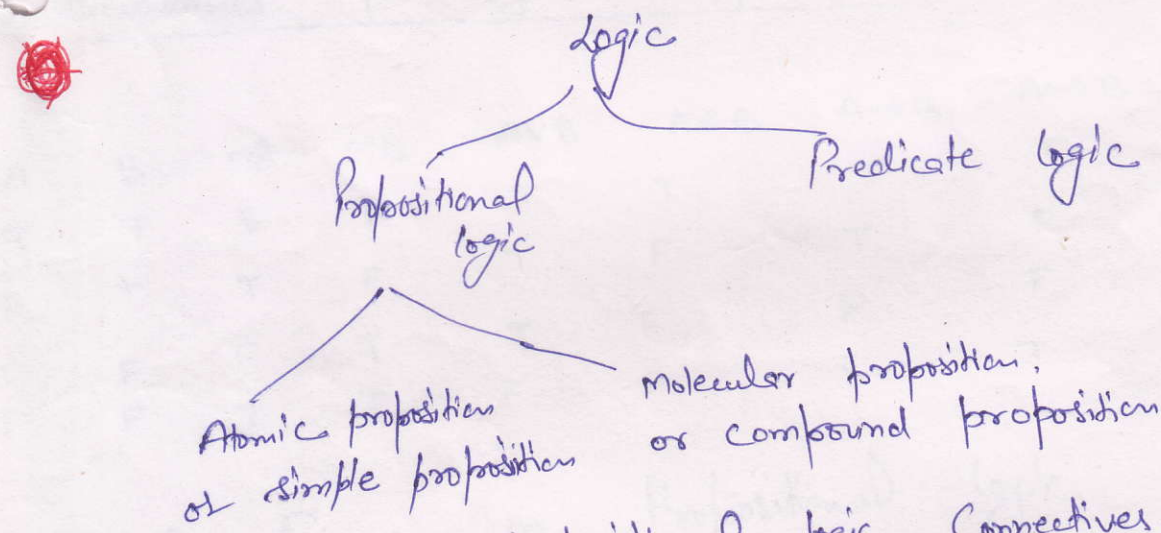
Many surgeons now use robotic assistants in micro surgery. HipNav is a system that uses vision technique to create a 3D model of a patient internal anatomy and then uses robotic control to guide the insertion of hip replacement.

6) Language Understanding & Problem solving

Proverb is a computer program that solves crossword puzzels better than most humans, using constraints on possible word fillers, a large database of past puzzels and a variety of information sources including dictionary and online database suchas list of movies and the actors that appears in them.

Logic

Logic :- It can be defined as a scientific study of process of reasoning and system of rules and procedure that help in reasoning process. Logic process takes in some information called premises and produce some output called conclusion.



Commonly used propositional logic Connectives.

1.	Conjunction	AND	&
2.	Disjunction	OR	V
3.	Negation	NOT	~
4.	material condition	Implies	→
5.	material biconditional	IFF	↔
6.	Exclusive disjunction	XOR	⊕
7.	Joint Denial	NAND	↑
8.	Disjoint Denial	NOR	↓

Syntax of Propositional logic

$\sim A$	(Negation of A)
$A \& B$	(Conjunction of A with B)
$A \vee B$	(Inclusive disjunction of A with B)
$A \rightarrow B$	(A implies B)
$A \leftrightarrow B$	(Material biconditional of A with B)
$(A \oplus B)$	(Exclusive disjunction of A with B)
$(A \mid B)$	(Joint Denial of A with B)
$(A \downarrow B)$	(Disjoint denial of A with B)

Semantics of Logical Propositions.

A	B	$\sim A$	$\sim B$	$A \vee B$	$A \& B$	$A \rightarrow B$	$A \leftrightarrow B$	$A \oplus B$	$A \mid B$	$A \downarrow B$
T	T	F	F	T	T	T	T	F	F	F
T	F	F	T	T	F	F	F	T	T	F
F	T	T	F	T	F	T	F	T	T	F
F	F	T	T	F	F	T	T	F	T	T

Normal forms in Propositional logic

In propositional logic there are two normal forms. That are Conjunctive Normal form (CNF) and Disjunctive Normal Form (DNF)

1. CNF :- A formula A is said to be in CNF if it has the form

$$A = A_1 \& A_2 \& A_3 \cdots \& A_n, \quad n \geq 1$$

where each $A_1, A_2 \cdots A_n$ is a disjunction of an atom or negation of an atom.

DNF :-

A formula A is said to be in DNF if it has the form

$A = A_1 \vee A_2 \vee A_3 \cdots \vee A_n \quad , n \geq 1$

where each $A_1, A_2 \cdots, A_n$ is a conjunction of an atom or negation of an atom.

Conversion Procedure to Normal form

1) Eliminate implication and biconditional signs.
2) Reduce the scope of negation operator by using Demorgan's law to place the operator just before the atom.
3). Use Distributive laws and other equivalent formula to obtain the normal form.

eg. 1) $(A \to ((B \leftrightarrow C) \to D))$ to DNF

$\sim A \vee ((B \leftrightarrow C) \to D)$

$\sim A \vee (\sim (B \leftrightarrow C) \vee D)$

$\sim A \vee \sim B \vee \sim C \vee D.$

2) $((A \to B) \to C)$ to CNF

$\sim (A \to B) \vee C$

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

$(A \wedge \sim B) \vee C$

$(A \vee C) \wedge (\sim B \vee C).$

Predicate logic

Propositional logic works fine in the situations where the result is either true or false, but not both. There are some real life situations that cannot be treated this way.

In order to overcome this deficiency, first order logic or predicate logic is used to represent the statements.

Syntax of FOPL :-

Connectives :-

Five connectives are used in predicate logic that are

$\sim$	Negation.
$\wedge$	AND
$\vee$	OR
$\rightarrow$	Implication.
$\leftrightarrow$	Biconditional.

Quantifiers :-

Two quantifier symbols used are

$\exists$ (existential quantifier) → for some or their is an

$\forall$ (universal quantifier) → for all.

Constants :-

Fixed value, a, b, c, --- 5, 10 ....

Variables :-

Variable value or different values over a given domain.

Functions :- Function symbol denote relations defined on a domain D. They map n elements ($n \geq 0$) to a single element of domain.

Predicates :- Predicate symbol denote relations or functions mapping from the elements of a domain D to the values true or false.

It is defined on a relation that binds two terms together. Each predicate has a name followed by list of arguments.

eg:- Ram likes apple.

likes (Ram, apple).

1) Marcus was a man.
2) Marcus was a Pompeian
3) All pompeians were Roman.
4) Caesar was a ruler.
5) All Romans were either loyal to Caesar or hated him.
6) Everyone is loyal to someone
7) Marcus tried to assissinate Caesar

⇒ man (marcus)

Pompeian (marcus)

$\forall x$: Pompeain (x) → Roman(x)

Ruler (Caesar)

$\forall x$: Roman (x) → loyalto (x, caesar) ∨ hate (x, caesar)

$\forall x : \exists y$: loyalto (x, y)

trytoassirsinate (Marcus, Caesar)

Normal form in Predicate logic :-

The normal form in predicate logic is known as Prenex Normal form :-

A formula A in predicate logic is said to be in prenex normal form if it has form :-

$$Q_1 x_1 Q_2 x_2 \dots (Q_i x_i) B.$$

where $Q_i x_i$ is either $\forall$ or $\exists$ quantifiers and B is the formula without quantifier.

Conversion to Clausal form :-

1. Remove the implication and biconditional sign.
2. Resolve the scope of negation operator and apply any demorgan laws.
3. Rename the variable if required.
4. Skolimize existially quantified variable by replacing the existinal quantifier with skolem fn. by eliminating the existential quantifier
5. Take all the universal quantifiers to the left and make the formula right into CNF.
6. Eliminate the universal quantifiers and conjunction