1) Explain propositional logic with example.

→ Propositional logic (PL) is the simplest form of logic where all the statement are made by propositions. A proposition is a declarative which is either true or false. it is technique of knowledge representation in logical and mathematical form.

Example :-

a) It is Sunday

b) The sun rises from west (false proposition)

c) 3+3 = 7 (false proposition.

Following are some basic fact about propositional logic.

- propositional logic is also called Boolean logic as it works on 0 and 1.
- In propositional logic, we use symbolic variables to represent the logic, and we can use any symbol for representing a proposition A, B, C, D, E, F etc.
- Proposition can be either true or false, but it cannot be both.
- Propositional logic consist of an object relation or function and logical connectives.
- The proposition and connectives are the basic elements of propositional logic
- Connectives can be said as logical operator which connects two sentences.
- A proposition formula which is always true is called tautology, and it is also called valid sentence.

- A proposition formula is always is called contradiction.
- A proposition formula which has both true and false value is called.
- Statement which are question, command, or opinions are not propositions such as "where is Rohini", "How are you", "what is your name", are not proposition.

Syntax of propositional logic.

1) Atomic proposition. :-
are the simple propositions. It consist of a single proposition symbol.

Ex. a) 2 + 2 is 4, it is an atomic proposition as it is a true fact.
b) "The sun is cold" is also proposition as it a false fact.

2) Compound proposition :-
are constructed by simpler or atomic proposition, using parenthesis and logical connectives.

Ex. a) "It raining today, and street is wet."
b) "Ankit is a doctor, and his clinic is in Mumbai.

2) Logical connectives. :-
Logical connectives are used to connect two simpler proposition or representing a sentence logically. we can create compound proposition with the help of logical connectives.

1) Negation :- A sentence such as $\neg P$ is called negation of P.

2) Conjunction :- A sentence which has $\wedge$ connective such as, $P \wedge Q$ is called Conjunction.
Ex. :- Rohan is intelligent and hardworking.
P = Rohan is intelligent.
Q = Rohan is hardworking $\rightarrow P \wedge Q$.

3) Disjunction :- A sentence which has $\vee$ connection such as $P \vee Q$. is called disjunction. where P and Q are propositions.
Ex. "Ritika is doctor or Engineer."
Here P = Ritika is Doctor. Q = Ritika is doctor, so we can write it as $P \vee Q$.

4) Implication :- A sentence such as $P \rightarrow Q$ is called an implication, implication are also known as if-then rules. It can be represent as.
If it is raining, then the street is wet.
Let P = it is raining, and Q = street is wet, so it is represented as $P \rightarrow Q$.

5) Biconditional : A sentence such as $P \rightleftarrows Q$ is Biconditional sentence, example if I am breathing then I am alive.
P = I am breathing. Q = I am alive. it can be represented as $P \rightleftarrows Q$.

3) Interference :-
In artificial intelligence. we need intelligent computers which can create new logic from old or by evidence, so generating the conclusion from

evidence and facts is termed as inference.

Inference rules:-

Inference rules are the templetes for generating valid arguments. Inference rules are applied to derive proof in artificial intelligence and proof is sequence of conclusion that leads to the desired goal.

- Implication :- It is one of the logical connectives which can be represented as $P \rightarrow Q$, it is Boolean expression.

- Converse :- The converse of implication, which means the right-hand side proposition goes to left-hand and vice-versa. It can be written as $Q \rightarrow P$.

- Contrapositive :- The negation of converse is termed as contrapositive, and it can be represented as $\neg Q \rightarrow \neg P$.

- Inverse :- The negation of implication is called inverse. It can be represented as $\neg P \rightarrow \neg Q$.

4) PEAS description of Wumpus world :-

① Performance measure :-

- +1000 reward point if the agent comes out of the cave with the gold.
- -1000 points penalty for being eaten by wumpus or falling into the pit.

- -1 for each action. and -10 for using an arrow.
- The game ends if either agent dies or came out of the cave.

② Environment :-

- A 4*4 grid of rooms.
- The agent initially in room square [1,1] facing toward the right.
- Location of wumpus and gold are choose randomly except the first square.
- Each square of cave can be pit with probability 0.2 except the first square.

③ Actuators :-

- Left turn
- Right turn
- Move forword.
- Grab
- Release
- Shoot

④ Sensors :-

- The agent will pursive the stench if he is in the room adjucent to the wumpus.
- The agent will pursive breeze if he is in the room directly adjucent to the pit.
- The agent will pursive glitter in the room where the gold is present.
- The agent will ~~pur~~perscieve the bump, if he walk into wall.
- when the wu~~pt~~mpus is shot, it emits a horrible screm which can be percieved anywhere in the cave.

- The percept can be represented as five element list, in which we will have different indicators for each sensor.

5) Quantifiers in first-order logic :

- A quantifier is a language element which generates quantification specifies the quantity to specimen the universe of discourse.

- These are the symbol the permit to determine or identify the range and scope of variable in the logical expression. There are two types of quantifiers.

a) Universal quantifier.
b) Existential quantifier

Universal Quantifier :-
is a symbol of logical representation which specifies that the statement within us range is true for everything or every instance of particular thing.

The universal quantifier is represented by a symbol $\forall$, which resembles an inverted A. if x is a variable, then $\forall x$ read as :-

For all x
For each x
For every x

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Existentical Quantifier. :-

Existential quantifier are which express that the statement within its scope is true for atleast one instance of something.

It is denoted by the logical operator $\exists$, which resembles as inverted E. when it is used with a predicate variable then it is called as an existential quantifier.

if x is a variable, then existantial quantifier will be $\exists x$ or $\exists(x)$. And it will be read as:

- There exists a 'x'.
- For some 'x'.
- for at least one 'x'.