Propositional logic (Either True, or false, but both)

Statement | Reasoning

- ✓ 1+1=2
- ✓ printf(" "
- ✓ This is Table

T / f

Syntax

12+=4 ✗
Printf ✗

Semantic (meaning)

T f

✓
- 1+1=2 : T
- 2+1=4 : f
- MDSC = T

✗ Some students are Intelli

(T/F)

Atomic | (Complex / Composite)

Single proposition

M+1=2 T
— f

Multiple Statement:

P	Q	∨	∧	→	↔
T	T	T	T	T	T
T	f	T	f	f	f
f	T	T	f	T	f
f	f	f	f	T	T

← Negation → Today is not friday (¬P)

∨ - Disjunction (OR) You should eat or watch TV at a time (P ∨ Q)

∧ - Conjunction (AND) Please like my video & (P ∧ Q)

→ if then (implies) P → Q (if there is rain then the roads are wet)

↔ iff → I will go to mall iff I have to do shopping (bidirectional)

You can access the internet from campus only if you are IT student or you are not freshmen.

P → Q ∨ R

Agent Intelligent or machine Intelligent:

Knowledge Representation and Reasoning

Knowledge :- facts, or Skill, ← from experience

↳ Intelligence (ability to use Knowledge)

~~Collected~~ by

Reasoning → Processing of Knowledge. (Thinking)

KIR :- Knowledge, Intelligence, Reasoning

Knowledge → 20 floor.
Reasoning → Yes / ~~Know~~ no
Intelligence → Yes / No.

Program → output
no knowledge Representation → Syntax / Semantic

AI → Knowledge Representation — logic
- Logic: Propositional logic (True/false)
- Predicate logic (Quantifier ∀ ∃)

→ Rules → if then → m/c Act

→ Semantic Net → Google graph
↓ meaning graph
└ Inference – Value

[Cow]

[Train ticket]

frames — (slots → objects) (fillers – Attributes)

→ Scripts → Action (movie, songs)

Predicate logic

20 is Smaller than 10 → false
6 is an even no. → True
} Propositional logic

Variable

x is Smaller than 10
x is an even no.
} not true / not false when variable is given ↓ Predicate logic

x is greater than y

All from → $\vee, \wedge, \neg, \rightarrow, \leftrightarrow$

Quantifier
- Universal quantifier $\forall$ ($\wedge$)
- Existential quantifier $\exists$ ($\vee$)

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x is Smaller than 10

$P(x)$

$P(1) \rightarrow T$
$P(5) - T$
$P(15) - f$

x is Smaller than y

$Q(x, y)$

$\forall x P(x)$ → for All / Every Value

Value of x – Domain {1, 3, 5, 7}, $\overset{T}{=}$ 70 – f

$\forall x P(x) =$ True / $\forall x P(x) =$ False

$\exists$ → Some, Any

x is Smaller than 10 ⟶ $Q(x)$

Domain : { 1, 3, 5, 15 }
T, T, T, F

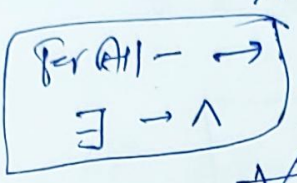
$\exists x\, Q(x)$ - There exist Some Value of x Smaller than 10

$\exists x\, Q(x) =$ True

Domain (5, 15, 25, 35) $\exists x\, Q(x) =$ True
T F F F

first order logic → Predicate logic FOPL

Not All that Glitter is Gold



x

~~G(x)~~

$\forall x$ Glitter(x) Gold(x)

✓ $\forall x$ Glitter(x) → Gold(x) ✓

or

$\forall x$ Glitter(x) ∧ Gold(x)

A	B	
0	0	T
0	1	T
1	0	F
1	1	T

~ $\forall x$ Glitter(x) → Gold(x)

A → B

A	B	o/p
0	0	0
0	1	0
1	0	0
1	1	1

$A \rightarrow B \equiv A' + B$

$\sim [\forall x (\sim \text{Glitter}(x) \vee \text{Gold}(x))]$

$\exists x \text{ Glitter}(x) \wedge \sim \text{Gold}(x)$

there exist a metal x which is Glittering but it is not gold (Aluminium)

fopL – world in term of objects

(1) All Boys like football – $\forall x : Boys(x)$

(2) Some Boys like football

$\forall x \; Boys(x) \rightarrow like(x, football)$

$\exists x \; Boys(x) \wedge like(x, football)$

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(1) Every child loves Every Candy

$\forall x \forall y : child(x) \wedge Candy(y) \rightarrow loves(x, y)$

(2) Anyone who loves Some Candy is not a nutrition fanatic

$\forall x \exists y : Candy(y) \wedge lovers(x, y) \rightarrow \neg \; nutrition\ fantic(x)$

(3) Anyone who eats a pumpkin is a nutrition fanatic

$\forall x \exists y : 'pubkin(y) \wedge (eats\ x, y) \rightarrow nutrition\ fanatic(x)$

(4) Anyone who buys any pumpkins either craves it or eats it

$\forall x \forall y : pumpkin(y) \wedge buys(x, y) \rightarrow craves(x, y) \vee eat(x, y)$

(5) John buys a pumpkin

$\exists x : pumpkin(x) \wedge buys(John, x)$

(6) Life Saver is a candy

$candy(lifesaver)$

Resolution → Various Statement → one Conclusion.

→ If it is Sunny & warm day you will enjoy
→ if it is raining you will get wet
→ It is a warm day
→ it is raining
→ it is Sunny

Goal :- you will enjoy

(1) Convert facts in to FOL
(2) Convert FOL in to CNF (Conjuctive Normal form)
(3) Negate the statement to be proved
(4) Draw Resolution Graph.

(1) Convert facts in to FOL

(1) if it is sunny & warm day you will enjoy.

(2) Sunny ∧ warm ⟶ Enjoy

(2) if it is raining you will get wet

raining ⟶ wet

(3) it is a warm day warm

(4) it is raining raining

(5) it is sunny sunny

CNF → $a \rightarrow b = \neg a \vee b$

(3) warm
(4) raining
(5) sunny

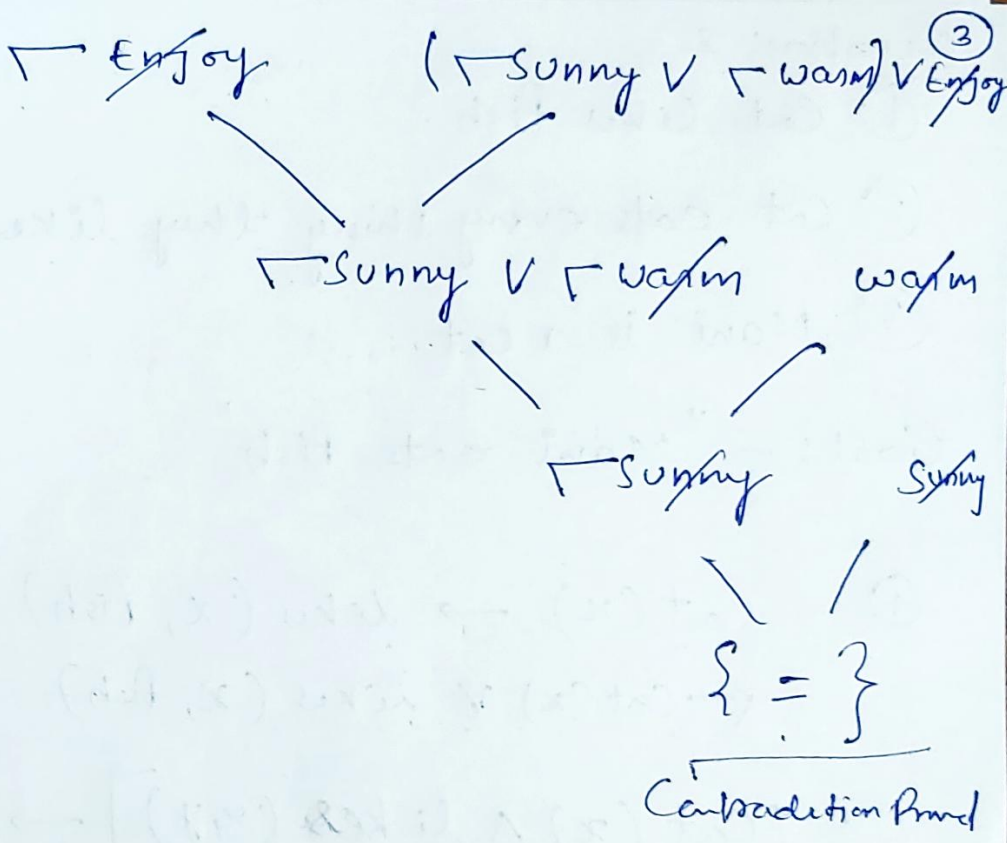
(1) $\neg(\text{sunny} \wedge \text{warm}) \vee \text{Enjoy}$

$(\neg\text{sunny} \vee \neg\text{warm}) \vee \text{Enjoy}$

(2) $\neg\text{raining} \vee \text{wet}$

(3) Negate the statement to be proved

(6) $\neg$ enjoy



Resolution: It is proved by Contradiction.

Question: 2

(4)

(1) Cat likes fish

(2) Cat eats every thing they like

(3) Mani is a cat

Goal:- "Mani eats fish"

(1) $Cat(x) \rightarrow likes(x, fish)$

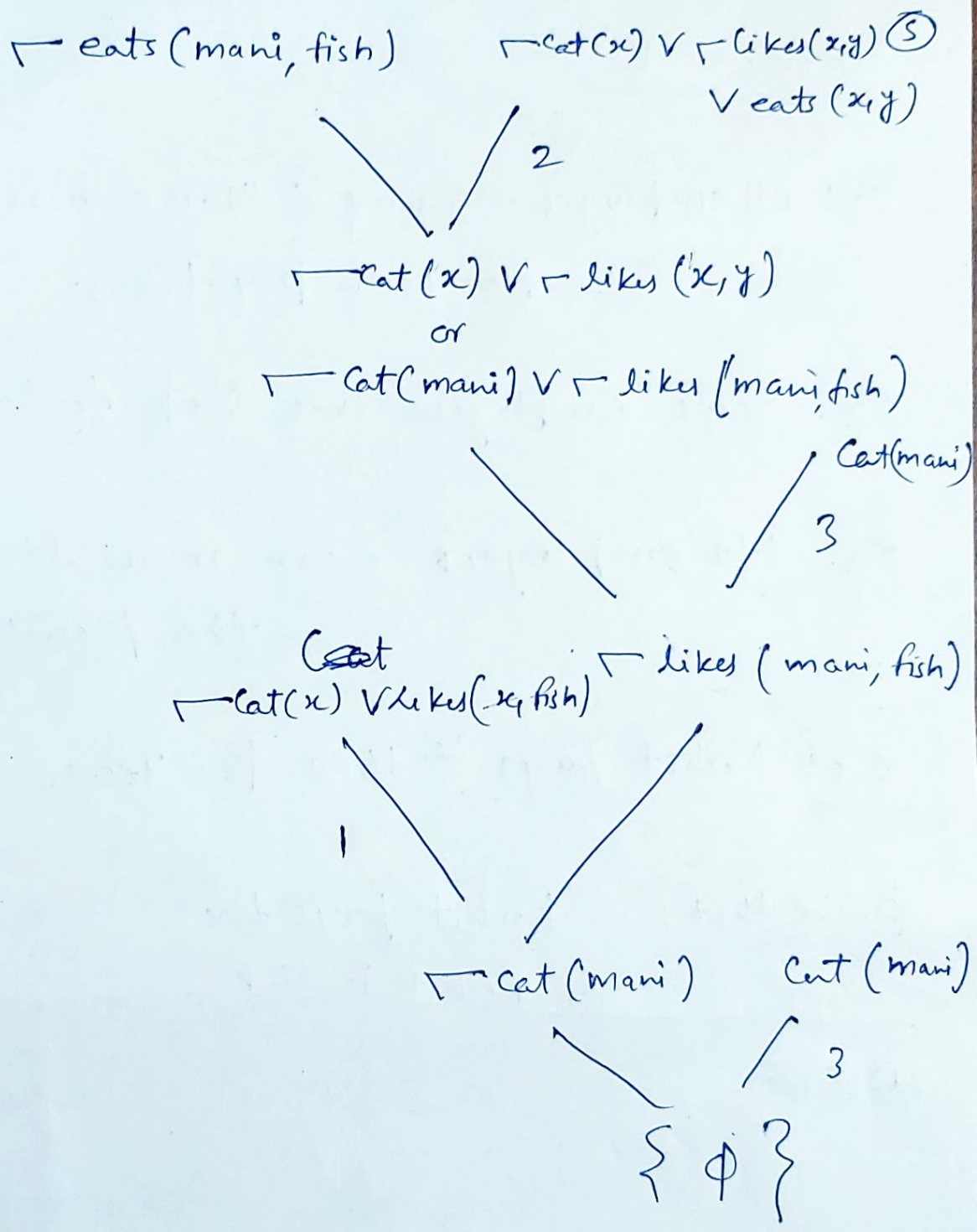
$\neg Cat(x) \vee likes(x, fish)$

(2) $[Cat(x) \wedge likes(x,y)] \rightarrow eats(x,y)$

$\neg Cat(x) \vee \neg likes(x,y) \vee eats(x,y)$

(3) $Cat(mani)$

(4) $eats(mani, fish)$


¬ eats (mani, fish)
¬ cat(x) V ¬ likes(x,y) (5)
V eats (x,y)
2
¬ cat (x) V ¬ likes (x, y)
or
¬ cat(mani) V ¬ likes (mani, fish)
cat(mani)
3
¬ likes (mani, fish)
¬ cat(x) V likes(x, fish)
1
¬ cat (mani)
cat (mani)
3
{ ϕ }