

School of Computer Science Engineering and Technology

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| Course-B.Tech | Type- Core |
| Course Code- CSET106 | Course Name- Discrete Mathematical Structures |
| Year- 2024 | Semester- Even |
| Date- 02/02/2024 | Batch- 2023-2027 |

CO-Mapping

| | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 |
|-----|----|----|----|----|----|----|----|
| CO1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| CO2 | | | | | | | |
| CO3 | | | | | | | |

Objectives

1. Students will be able to check the validity of arguments and infer the valid conclusion.
2. Students will be able to learn the significance of Predicate and Quantifiers.
3. Students will be able to learn the conversion of English language in logical language and vice versa.

Questions:

1. Use inference rules of propositional logic to check the validity of the following arguments.
 - a) If I run, I will get there quicker. I got there quicker. Therefore, I must have ran.
 - b) If I run, I will get there quicker. I did not run. Therefore, I did not get there quicker.
 - c) If Bennett University is in Greater Noida, then Bennett University is in UP. Bennett University is in UP Therefore, Bennett University is in Greater Noida.
 - d) Jatin is either a policeman or a footballer. If he is a policeman, then he has big feet. Jatin does not have big feet, so he is a footballer.
 - e) If the company invests in renewable energy, it will reduce its carbon footprint. The company has decided to invest in renewable energy. Either the company reduces its carbon footprint, or it faces public backlash. Therefore, the company will not face public backlash.
 - f) If a student attend lectures of DMS, student's understanding of computer science will improve. Students' understanding of computer science has not improved. If a student is not attending lectures, either student is not present on campus or DMS examination is not tough. Continuous evaluation policy confirms that the student is present on campus. Therefore, DMS examination is not tough.
2. Write the symbolic form of the following sentences without using the notion of universe of discourse.
 - a) All lawyers are liars.
 - b) Some lawyers are not liars.
 - c) Any person who becomes a politician will get corrupt.
 - d) No doctors know calculus.
 - e) For every positive integer, there is a positive integer greater than it.
 - f) Every integer is either positive or negative.

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3. Write the symbolic form of the following sentences using appropriate Predicate and Quantifier.

- Every Indian festival is celebrated either based on solar or lunar calendars.
- Every citizen is eligible to vote if and only if they are above 18 years of age.
- In a family, every member either enjoys spicy food and dislikes sweets or has a sweet tooth but prefers mild flavors.
- Every even number greater than 2 can be expressed as the sum of two primes.

4. Translate each of the following predicate into an English statement.

- $\forall x: (P(x) \rightarrow \forall y: (F(y) \rightarrow \neg I(x, y)))$, where $P(x)$: x is a program, $F(x)$: x is a function and $I(x, y)$: x invokes y .
- $\exists x: (s(x) \wedge \forall y: (s(y) \rightarrow (x = y)))$, where $s(x)$: x is a book on the table.
- $\forall x: \text{prime}(x) \wedge \text{greater}(x, 2) \rightarrow \text{odd}(x)$.
- $\exists x \forall y: x + y = y$, provided the universe of discourse consists of all real numbers.

5. Consider the following predicates:

$P(x, y): x > y$

$Q(x, y): x \leq y$

$R(x): x - 7 = 2$

$S(x): x > 9$

If the universe of discourse is the real numbers, give the truth value of each of the following propositions:

- $\exists x: R(x)$
- $\forall y: \neg S(y)$
- $\forall x \exists y: P(x, y)$
- $\exists y \forall x: Q(x, y)$
- $\forall x \forall y: (P(x, y) \vee Q(x, y))$
- $\exists x: S(x) \wedge \neg (\forall x: R(x))$
- $\exists y \forall x: S(y) \wedge Q(x, y)$
- $\forall x \forall y: (R(x) \wedge S(y)) \rightarrow Q(x, y)$

6. Use predicate logic to check whether the following arguments are valid or not.

- All foods that are healthy to eat do not taste good. Tofu is healthy to eat. You only eat what tastes good. Therefore, you do not eat tofu.
- Everyone from Bennet University lives within 50 km of the India Gate. Someone from Bennet University has never seen the India Gate. Therefore, who lives within 50 km of the India Gate has never seen the India Gate.
- All protons are subatomic particles. All neutrons are subatomic particles. Hence, all protons are neutrons.

7. You are on an island with two tribes of people - one tribe, called the Truth Tribe, always tell the truth, and the other, called the Lie Tribe, always lie.

Two natives, A and B approach you and they say the following:

A: Both of us are from the Truth Tribe

B: A is from the Lie Tribe.

Use propositional logic to identify who is from which tribe?

Logic is not a theory but a reflection of the world. Logic takes care of itself. All we have to do is to look and see how it does it.

-Ludwig Wittgenstein