Lecture Notes: Logic

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1 Overview

> **Key Points**
>
> - Understanding and combining logic statements with other logical expressions

2 Detailed Notes

2.1 Logical Statements

A statement is a declarative statement assertion that is either true or false but not both (T, F $\implies 1, 0$) are called boolean values

Example

- Number 4 is even (T)

- Number 7 is odd (T)

- number 5 is divisible by 3 (F)

An open sentence is a statement that contains one or more verbs

The range of possible value of these variables is called the domain of open sentence, often denoted by $\mathbb{S}$
Number $\mathbb{N}$ is even so we usually denote open sentences by $p(x) : x \in \mathbb{S}$

2.2 Combining Statements

2.2.1 Negation

Negation: given a statement P it's negation "Not P" is denoted by $\neg P$
Example

- Number 4 is not even

- Number 4 is odd

This is a more concrete example Establishing knowledge

- $P(N)$: Number n is odd, $S = \{1, 2, 3, 4\}$

- $\neg P(N)$: number n is even, $S = \{1, 2, 3, 4\}$

- $\neg P(1) : F$

- $\neg P(2) : T$

- $\neg P(3) : F$

- $\neg P(4) : T$

2.2.2 Disjunction

Given statements P, Q their disjunction, denoted by $P \vee Q$ is a statement P or Q
Example)

- P: I am going to be at a bar tonight

- Q: I am going to the movies tonight

Truth Table

p	q
T	T
T	F
F	T
F	F

2.2.3 Conjucntion

Given statements P, Q their conjunction denoted by $P \wedge Q$ is the statement P and Q and is true only when the both of them are true

3 Important Formulas/Theorems/Definitions

Key Formula/Theorem

State an important formula or theorem here

4   Examples

Example 1:
$$P(N) : \text{number n is odd}, s = \{1, 2, 3, 4\} \tag{1}$$

- $P(1) : T$

- $P(2) : F$

- $P(3) : T$

- $P(4) : F$

Example 2:
$$P(x, y) \text{ is divisible by } x + y \tag{2}$$
$$S = \{a, b\} a \in \{1, 2, 3\}, b \in \{1, 2\} \tag{3}$$

- P(1,1) = 1 * 1 is -1 -1 -1 + 1 this statement is false

- P(1,2) = 1 * 2 is -1 -1 -1 + 1 this statement is false

- P(2,1) this statement is false

5   Questions/Topics for Further Study

- Question or topic for further study