Mathematics for Computer Science

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Week1 self-study Exercise

**1. Scenario Analysis**

In programming, the expression **PꓥQ** represents a logical **AND** condition, meaning both conditions must be true for the final result to be true. For example, in a login system:

Let **P**=”User is logged in” and **Q**

=”User is an admin”

Access to admin dashboard is granted only if **both** P and Q are true. This logic ensures restricted access to sensitive areas.

**Truth Table:**

ꓲ P ꓲ Q ꓲ P ꓥ Q ꓲ

ꓲ---ꓲ---ꓲ--------ꓲ

ꓲ T ꓲ T ꓲ T ꓲ

ꓲ T ꓲ F ꓲ F ꓲ

ꓲ F ꓲ T ꓲ F ꓲ

ꓲ F ꓲ F ꓲ F ꓲ

**2. Truth Table Construction Build truth tables for (P→Q) and (Pꓥ¬Q).100 Words Explanation of results.**

**(P→Q)** means if **P then Q**. It’s only false if P IS true and Q IS false.

**Truth Table for (P → Q):**

ꓲ P ꓲ Q ꓲ P → Q ꓲ

ꓲ---ꓲ---ꓲ--------ꓲ

ꓲ T ꓲ T ꓲ T ꓲ

ꓲ T ꓲ F ꓲ F ꓲ

ꓲ F ꓲ T ꓲ F ꓲ

ꓲ F ꓲ F ꓲ T ꓲ

**(Pꓥ¬Q)** Means P is true and Q IS false.

**Truth Table:**

ꓲ P ꓲ Q ꓲ ¬ Q ꓲ P¬ Q ꓲ

ꓲ---ꓲ---ꓲ---ꓲ--------ꓲ

ꓲ T ꓲ T ꓲ F ꓲ F ꓲ

ꓲ T ꓲ F ꓲ T ꓲ T ꓲ

ꓲ F ꓲ T ꓲ F ꓲ F ꓲ

ꓲ F ꓲ F ꓲ T ꓲ F ꓲ

**Explanation:**

(P→Q) shows conditional logic: the only case it fails is when P is true but Q is false. (Pꓥ¬Q) identifies when P is true and Q is false, often used to trigger exceptions or alert in code.

**3. Logic Research**

Research one connective (e.g., implication). 100 words summary of its role in programming.

The implication connective (→) is used in programming to express conditional logic: “If P, THEN Q”. It allows control structures like if –then statements. This is vital in decision-making processes. For instance, if (user\_ logged\_ in) then shows \_dashboard: reflects P→Q logic. If the condition (P) is true, the consequence (Q) must follow. This ensures actions are only taken when specific conditions are met, improving program reliability and safety.

**4. Application Exploration 100-words summary of how logic applies to SQL queries or circuits.**

Logic is foundational to SQL queries and digital circuits. In SQ, logical operators like **AND,** **OR,** and **NOT** filter data\_ ’SELECT\*FROM users WHERE age>18 AND verified =true’ applies logical conjunction. Similarly, circuits use logic gates **(AND, OR, NOT)** to process binary signals, for instance, a digital lock may only open (output high) if both correct code and fingerprint match an **AND** gate scenario. Logical thinking ensures systems behave predictably under specific conditions, critical in databases and hardware.