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| **Alexandria Higher Institute of Engineering & Technology (AIET)** | | |
| **Computer Engineering (CE) Department** | | **2 rd Year** |
| **CE 171** | **Introduction to Discrete Mathematics** | **I st Semester, 2017-2018** |
| **Instructor** | **Dr Dalia Elkamchouchi** | **Sheet (1)** |

# Sheet (1)
## The logic of compound statements

**Question 1:**

Indicate which of the following sentences are statements:

(a) She is a mathematics major.

(b) $128 = 2_6$.

(c) $x = 2_6$.

**Question2:**

Write the statements in symbolic form using the symbols ~, ∧ and ∨ and the indicated letters to represent component statements.

**1**. Let s = "stocks are increasing" and i = "interest rates are steady".

(a) Stocks are increasing but interest rates are steady.

(b) Neither are stocks increasing nor interest rates steady.

**2**. Let h = "John is healthy", w = "John is wealthy" and s = "John is wise".

(a) John is healthy and wealthy but not wise.

(b) John is not wealthy but he is healthy and wise.

(c) John is neither healthy, wealthy, nor wise.

**3**. Let p be the statement "DATAENDFLAG is off", q the statement "ERROR equals 0" and r the statement "SUM is less than 1,000."

(a) DATAENDFLAG is off, ERROR equals 0, and SUM is less than 1,000.

(b) DATAENDFLAG is off but ERROR is not equal to 0.

(c) DATAENDFLAG is off; however ERROR is not 0 or SUM is greater than or equal to 1,000.

(d) DATAENDFLAG is on and ERROR equals 0 but SUM is greater than or equal to 1,000.

**Question3:**

Write truth tables for the following statement form:

1. $\sim p \wedge q$
2. $(p \wedge q) \vee \sim (p \vee q)$
3. $p \wedge (q \wedge r)$
4. $\sim p \wedge (q \vee \sim r)$

**Question4:**

Determine which of the pairs of statement forms are logically equivalent. Justify your answers using truth tables.

1. $p \vee (p \wedge q)$ and $p$.
2. $\sim (p \vee q)$ and $\sim p \wedge \sim q$ .
3. $(p \vee q) \vee (p \wedge r)$ and $(p \vee q) \wedge r$ .
4. $(r \vee p) \wedge ((\sim r \vee (p \wedge q)) \wedge (r \vee q))$ and $p \wedge q$.

**Question5:**

Use De Morgan's laws to write negations for the following statements:

1. Hala is a math major and Hala's sister is a computer science major.
2. Sam swims on Thursdays and John plays tennis on Saturdays.
3. The connector is loose or the machine is unplugged.

**Question6:**

Use truth tables to establish which of the statement forms are tautologies and which are contradictions.

1. $(p \wedge q) \vee (\sim p \vee (p \wedge \sim q))$
2. $(p \wedge \sim q) \wedge (\sim p \vee q)$
3. $(\sim p \vee q) \vee (p \wedge \sim q)$

**Question7:**

Use Theorem 1.1.1 to verify the logical equivalences:

1. $(p \wedge \sim q) \vee p \equiv p$
2. $\sim (p \vee \sim q) \vee (\sim p \wedge \sim q) \equiv \sim p$
3. $\sim ((\sim p \wedge q) \vee (\sim p \wedge \sim q)) \vee (p \wedge q) \equiv p$