Session 3: Logical Mathematics and Literature

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1 Logical Mathematics

1.1 Theory

- Remember the definitions of negation, conjunction, disjunction, Exclusive OR, implication.

- Can rewrite a langual statement into a logical mathematics statement.

- Can write truth table

1.2 Exercises

1. Which of these are propositions? What are the truth values of those that are propositions?

    (a) Do not pass go.
    (b) What time is it?
    (c) There are no black flies in Maine.
    (d) $4 + x = 5$.
    (e) The moon is made of green cheese.
    (f) $2^n \geq 100$.

2. What is the negation of each of these propositions?

    (a) Mei has an MP3 player.
    (b) There is no pollution in New Jersey.
    (c) $2 + 1 = 3$.
    (d) $5 + 3 = 6$.
    (e) The summer in Maine is hot and sunny.

3. Suppose that during the most recent fiscal year, the annual revenue of Acme Computer was 138 billion dollars and its net profit was 8 billion dollars, the annual revenue of Nadir Software was 87 billion dollars and its net profit was 5 billion dollars, and the annual revenue of Quixote Media was 111 billion dollars and its net profit was 13 billion dollars. Determine the truth value of each of these propositions for the most recent fiscal year.

    (a) Quixote Media had the largest annual revenue.
    (b) Nadir Software had the lowest net profit and Acme Computer had the largest annual revenue.
    (c) Acme Computer had the largest net profit or Quixote Media had the largest net profit.
    (d) If Quixote Media had the smallest net profit, then Acme Computer had the largest annual revenue.
    (e) Nadir Software had the smallest net profit if and only if Acme Computer had the largest annual revenue.

4. Let p and q be the propositions "The election is decided" and "The votes have been counted," respectively. Express each of these compound propositions as an English sentence.

    (a) $\neg p$
    (b) $p \vee q$
    (c) $\neg p \wedge q$

(d) $q \rightarrow p$

(e) $\neg q \rightarrow \neg p$

(f) $\neg p \rightarrow \neg q$

(g) $\neg q \vee (\neg p \wedge q)$

5. Let p, q, and r be the propositions

   - p: You get an A on the final exam.
   - q: You do every exercise in this book.
   - r: You get an A in this class.

   Write these propositions using p, q, and r and logical connectives (including negations).

   (a) You get an A in this class, but you do not do every exercise in this book.

   (b) You get an A on the final, you do every exercise in this book, and you get an A in this class.

   (c) To get an A in this class, it is necessary for you to get an A on the final.

   (d) You get an A on the final, but you don't do every exercise in this book; nevertheless, you get an A in this class.

   (e) Getting an A on the final and doing every exercise in this book is sufficient for getting an A in this class.

   (f) You will get an A in this class if and only if you either do every exercise in this book or you get an A on the final.

6. Construct a truth table for each of these compound propositions.

   (a) $p \rightarrow \neg p$

   (b) $p \oplus (p \vee q)$

   (c) $(p \wedge q) \rightarrow (p \vee q)$

   (d) $p \rightarrow (\neg q \vee r)$

   (e) $(p \oplus q) \vee (p \oplus \neg q)$

   (f) $(p \rightarrow q) \rightarrow (q \rightarrow p)$

   (g) $\neg p \oplus \neg q$

   (h) $\neg p \rightarrow (q \rightarrow r)$

   (i) $(p \rightarrow q) \vee (\neg p \rightarrow r)$

   (j) $(p \rightarrow q) \wedge (\neg p \rightarrow r)$

7. Explain, without using a truth table, why $(p \vee \neg q) \wedge (q \vee \neg r) \wedge (r \vee \neg p)$ is true when p, q, and r have the same truth value and it is false otherwise.

2 Literature

Đọc "Những chiếc ấm đất" của Nguyễn Tuân: `https://trabavan.com/nhung-chiec-am-dat-nguyen-tuan/`