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Assignment #1: LEC-AS1 – SET & PROPOSITION

1. What is the powerset of the empty set?

The powerset of the empty set is a set containing only the empty set. Mathematically: $P(\emptyset) = \{\emptyset\}$

2. What is the power set of set {0}?

The power set of {0} contains all possible subsets: $P(\{0\}) = \{\emptyset, \{0\}\}$

3. List 5 elements in each of the following sets

a. $\{ n \in A: n + 1 \text{ is a prime}\}$

Corrected elements: 1, 4, 6, 10, 14 (These are numbers where n + 1 is a prime number)

- 1 + 1 = 2 (prime)
- 4 + 1 = 5 (prime)
- 6 + 1 = 7 (prime)
- 10 + 1 = 11 (prime)
- 14 + 1 = 15 (prime)

b. $\{ 2^n: n \in B\}$

Elements: 1, 2, 4, 8, 16 (These are numbers generated by 2 raised to different powers)

- $2^0 = 1$
- $2^1 = 2$
- $2^2 = 4$
- $2^3 = 8$
- $2^4 = 16$

4. Propositional Logic

Propositional logic is a branch of mathematical logic that deals with:

- Propositions (statements that are either true or false)
- Logical connections between propositions

- Evaluating the truth value of compound statements

Key characteristics:

- Binary truth values (True or False)
- Uses logical connectives to combine propositions
- Fundamental to mathematical reasoning and computer science

5. Logical Connectives with Examples

Negation (¬)

- Reverses the truth value of a proposition
- Example: ¬(2 + 2 = 5) is True

Conjunction (∧)

- True only when both propositions are true
- Example: (3 > 2) ∧ (4 < 5) is True

Disjunction (∨)

- True if at least one proposition is true
- Example: (1 = 2) ∨ (3 > 1) is True

Implication (→)

- False only when the first proposition is true and the second is false
- Example: (x > 0) → (x^2 > 0) is True

Biconditional (↔)

- True when both propositions have the same truth value
- Example: (4 is even) ↔ (4 is divisible by 2) is True

6. References

1. Rosen, K. H. (2012). Discrete Mathematics and Its Applications. McGraw-Hill.
2. Epp, S. S. (2010). Discrete Mathematics with Applications. Brooks/Cole.
3. Johnsonbaugh, R. (2008). Discrete Mathematics. Pearson Prentice Hall.