

On my honor, I have not given, nor received, nor witnessed any unauthorized assistance on this work.

Print name and sign: _____

Question:	1	2	3	4	5	Total
Points:	8	5	8	4	5	30
Score:						

1. Given the statement “If there is a hurricane, then it is raining” find the following:

- (a) (2 points) Give the original statement in formal propositional notation (i.e. define p , q , and the appropriate logical connectives).

- (b) (2 points) The inverse of the statement in propositional logic and English

- (c) (2 points) The converse of the statement in propositional logic and English

- (d) (2 points) The contrapositive of the statement in propositional logic and English.

2. (5 points) Show (via truth tables) that $(p \leftrightarrow q) \rightarrow (p \rightarrow q)$ is a tautology.

3. Let $A = \{w, x, y, z\}$ and $B = \{a, y\}$.

- (a) (1 point) Is $x \in A$? _____
- (b) (1 point) Is $\{a\} \in B$? _____
- (c) (1 point) Is $y \subseteq B$? _____
- (d) (1 point) Is $\{z\} \subseteq A$? _____
- (e) (2 points) Give the power set of B .

- (f) (2 points) Show $A \times B$.

4. Conversions:

- (a) (2 points) Convert 42 (base 10) to 8-bit binary (base 2).

- (b) (2 points) Convert 10011101 (8-bit binary, base 2) to hexadecimal (base 16)

5. Let $A = \{0, 2, 4, 6, 8, 10\}$, $B = \{0, 1, 2, 3, 4, 5, 6\}$ and $C = \{4, 5, 6, 7, 8, 9, 10\}$. Find:

- (a) (2 points) $(A \cup B) \cap C$

- (b) (3 points) Draw a Venn diagram representing the three sets.

Standard Sets:

- \mathbb{R} : set of real numbers
- \mathbb{Q} : set of rational numbers $\{a/b : a \in \mathbb{Z} \text{ and } b \in \mathbb{Z} \text{ and } b \neq 0\}$
- \mathbb{N} : set of natural numbers $\{0, 1, 2, 3\}$
- \mathbb{Z} : set of all integers $\{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$
- \mathbb{Z}^+ : set of positive integers $\{1, 2, 3, \dots\}$

Set Symbols:

- \subseteq : “is a subset of”
- \subset : “is a proper subset of”
- \in : “is an element of”

Identity Laws:	$p \wedge T \equiv p$ $p \vee F \equiv p$
Domination Laws:	$p \vee T \equiv T$ $p \wedge F \equiv F$
Idempotent Laws:	$p \vee p \equiv p$ $p \wedge p \equiv p$
Double negation Law:	$\neg(\neg p) \equiv p$
Commutative Laws:	$p \vee q \equiv q \vee p$ $p \wedge q \equiv q \wedge p$
Associative Laws:	$(p \vee q) \vee r \equiv p \vee (q \vee r)$ $(p \wedge q) \wedge r \equiv p \wedge (q \wedge r)$
Distributive Laws:	$p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$ $p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$
DeMorgan's Laws:	$\neg(p \wedge q) \equiv \neg p \vee \neg q$ $\neg(p \vee q) \equiv \neg p \wedge \neg q$
Absorption Laws:	$p \vee (p \wedge q) \equiv p$ $p \wedge (p \vee q) \equiv p$
Negation Laws:	$p \vee \neg p \equiv T$ $p \wedge \neg p \equiv F$