

1. Make a single, multi-column truth table to illustrate conjunction, disjunction, implication, equivalence, and negation. Head each “result” column with a symbolic expression.
2. Define:
 - Tautology
 - Contradiction
3. What are De Morgan’s Laws? Write them symbolically.
4. Define:
 - Modus ponens
 - Modus tollens
5. Using propositional logic, prove the following arguments (here “ \rightarrow ” means implication):
 - $A \wedge (B \rightarrow C) \wedge [(A \wedge B) \rightarrow (D \vee C')] \wedge B \rightarrow D$
 - $[(A \vee B') \rightarrow C] \wedge (C \rightarrow D) \wedge A \rightarrow D$
6. Given the following predicates:
 - $D(x)$ is “x is a dog”
 - $R(x)$ is “x is a rabbit”
 - $C(x,y)$ is “x chases y”Write in prose form (something that sounds like normal English!) the meaning of the following statements:
 - $(\forall y)(\forall x)[R(y) \wedge C(x,y) \rightarrow D(x)]$
 - $(\exists x)[D(x) \wedge (\forall y)[R(y) \rightarrow C(x,y)]]$
7. Define (related to set theory) and give any applicable symbolic notation for:
 - Empty set
 - Union
 - Intersection
 - Difference
 - Cartesian product
 - Power set
 - Cardinality
8. Define (in the context of relations and functions):
 - Domain
 - Range
 - Onto (surjective) functions
 - One-to-one (injective) functions
 - Bijective functions

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