

CSI 30 Fall 2014 Test 1

Instructions: Put your **name** on the test. **No** electronic devices allowed. Show **all** work and justify **all** answers, **unless** a question states that no justification is required. If you use a truth table to answer a question, do not just make a truth table; *show how the truth table is used to answer the question.*

- (1) (8 Points) For each of the following statements say if it is a proposition or not. *No justification required.*
 - (a) $2 + 7 = 9$
 - (b) $2 + 7 = 0$
 - (c) $x + 1 > y + 8$
 - (d) There are 46 letters in the English alphabet.
- (2) (9 Points) Let $P(x)$ be the predicate $2x + 10 > x$. For each expression, determine if it is true or false.
 - (a) $P(3)$
 - (b) $P(0)$
 - (c) $P(-10)$
- (3) (6 Points) Show that $\neg(A \rightarrow B) \rightarrow A$ is a tautology.
- (4) (6 Points) Find a propositional logic statement which is a contradiction. Show it is a contradiction.
- (5) (8 Points) Define the following terminology precisely.
 - (a) Rational Number.
 - (b) Tautology.
- (6) (8 Points) For each proposition, determine if it is a tautology, a contradiction, or a contingency.
 - (a) $A \leftrightarrow \neg A$
 - (b) $(A \vee B) \rightarrow (A \wedge B)$
- (7) (8 Points) Determine whether or not the pairs of propositions are logically equivalent or not.
 - (a) $P \rightarrow Q$ and $Q \rightarrow P$
 - (b) $A \rightarrow (A \wedge B)$ and $\neg A \vee (A \wedge B)$
- (8) (8 Points) Convert the following sentence into propositional logic (*No justification required.*):
The Bronx is in NYC and The Bronx is not in California.
Use:
Use $P \equiv$ "The Bronx is in NYC"
Use $Q \equiv$ "The Bronx is in California"
- (9) (8 Points) Negate each proposition.
 - (a) $A \vee \neg B$
 - (b) $\forall x \exists y \ x < y$
- (10) (8 Points) For each proposition indicate if it is true or false. The domain is given for each proposition. *Justify your answer.*
 - (a) $\exists x \ 5 + x > 209$ (domain: All integers larger than 500)
 - (b) $\forall y \ -7y < 7y$ (domain: All real numbers)
 - (c) $\exists x \exists y \ 2x + y = x + 2y$ (domain: All positive integers)
 - (d) $\forall x \forall y \ 2x + 3y > x + y$ (domain: All rational numbers)
- (11) (8 Points) For each proposition indicate if it is true or false. The domain is given for each proposition. *No justification required.*
 - (a) $\forall x \exists y \ x + y = 0$ (domain: All integers)
 - (b) $\exists x \exists y \ xy \neq yx$ (domain: All real numbers)
 - (c) $\exists y \ y^2 < y$ (domain: All positive real numbers)
 - (d) $\exists x \forall y \ xy = 0$ (domain: All positive rational numbers)
- (12) (8 Points) Prove that for all integers n , if n is even then $21n + 6$ is also even.
- (13) (8 Points) Prove that for integers n , if $5n + 2$ is odd then n is odd.