1. Construct a truth table for . (10%)
2. Show that is a tautology ***without using truth table***. (10%)
3. Show that and are logically equivalent. (10%)
4. Suppose that the domain of the propositional function *P*(*x*) consists of the integers 1, 2, 3, 4, and 5. Express these statements without using quantifiers, instead using only disjunctions, conjunctions, and negations. (15%)
5. ∃*x P*(*x*)
6. ∀*x P*(*x***)**
7. ∀*x*
8. Let *P*(*x*), *Q*(*x*), and *R*(*x*) be the statements “*x* is a lion,” “*x* is fierce,” and “*x* drinks coffee.” Assuming that the domain consists of all creatures, express these statements in the argument using quantifiers and *P*(*x*), *Q*(*x*), and *R*(*x*). (15%)
9. All lions are fierce.
10. Some lions do not drink coffee.
11. Some fierce creatures drink coffee.
12. Let *L*(*x*, *y*) be the statement “*x* loves *y*,” where the domain for both *x* and *y* consists of all people in the world. Use quantifiers to express each of these statements. (10%)
13. Nobody loves everybody.
14. Everyone loves himself or herself.
15. Determine the **truth value** of each of these statements if the domain for all variables consists of all integers. [**prove it****or give a counterexample***.*] (10%)
16. ∃*n* ∀*m* ( *mn* = *m*)
17. ∀*n* ∀*m* ∃*p* ( *p* = (*m + n*) / 2)
18. Express the negation of the statement so that all negation symbols immediately precede predicates.(10%*)*
19. Show that the premises “A student in this class has not read the book,” and “Everyone in this class passed the first exam” imply the conclusion “Someone who passed the first exam has not read the book.”(10%)