Russell Andlauer

CS-2300-002

Professor Olson

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CS-2300-002 Assignment 1

Section 1.3

11. Show that each conditional statement in Exercise 9 is a tautology without using truth tables.

Exercise 9)

**a) (*p ^ q*) 🡪 *p***

**b) *p🡪* (*p V q*)**

**c) ¬ *p🡪* (*p 🡪 q*)**

**d) (*p ^ q*) 🡪 (*p 🡪 q*)**

**e) ¬ (*p 🡪 q*) 🡪 *p***

**f) ¬ (*p🡪 q*)🡪 ¬*q***

12. Show that each conditional statement in Exercise 10 is a tautology without using truth tables.

Exercise 10)

**a) [¬*p ^* (*p V q*)] 🡪 *q***

**b) [(*p🡪 q*) ^ (*q🡪 r*)]🡪 (*p🡪 r*)**

**c) [*p ^* (*p🡪 q*)]🡪 *q***

**d) [(*p V q*) ^ (*p🡪 r*) ^ (*q🡪 r*)] 🡪 *r***

Section 1.4

5. Let *P*(*x*) be the statement “*x* spends more than five hours every weekday in class,” where the domain for *x* consists of all students. Express each of these quantifications in English.

**a) ∃*xP*(*x*)**

**b) ∀*xP*(*x*)**

**c) ∃*x* ¬*p*(*x*)**

**d) ∀*x* ¬*p*(*x*)**

6. Let *N*(*x*) be the statement “*x* has visited North Dakota,” where the domain consists of the students in your school. Express each of these quantifications in English.

**a) ∃*xN*(*x*)**

**b) ∀*xN*(*x*)**

**c) ¬∃*xN*(*x*)**

**d) ∃*x*¬*N*(*x*)**

**e) ¬∀*xN*(*x*)**

**f) ∀*x*¬*N*(*x*)**

13. Determine the truth value of each statement if the domain consists of all integers.

**a) ∀*n*(*n* + 1 > *n*)**

**b) ∃*n*(2*n* = 3*n*)**

**c) ∃*n*(*n* = −*n*)**

**d) ∀*n*(3*n* ≤ 4*n*)**

14. Determine the truth value of each statement if the domain consists of all real numbers.

**a) ∃*x*(*x*3 = −1)**

**b) ∃*x*(*x*4 < *x*2)**

**c) ∀*x*((−*x*)2 = *x*2)**

**d) ∀*x*(2*x* > *x*)**

32. Express each of these statements using quantifiers. Then form the negation of the statement so that no negation is to the left of a quantifier. Next, express the negation in simple English. (Do not simply use the phrase “It is not the case that.”)

**a) All dogs have fleas.**

**b) There is a horse that can add.**

**c) Every koala can climb.**

**d) No monkey can speak French.**

**e) There exists a pig that can swim and catch fish.**

33. Express each of these statements using quantifiers. Then form the negation of the statement, so that no negation is to the left of a quantifier. Next, express the negation in simple English. (Do not simply use the phrase “It is not the case that.”)

**a) Some old dogs can learn new tricks.**

**b) No rabbit knows calculus.**

**c) Every bird can fly.**

**d) There is no dog that can talk.**

**e) There is no one in this class who knows French and Russian.**