Sample: Discrete Mathematics - Statements and Truth Tables

- *Use a truth table to determine whether the following statement form is a tautology, a contradiction or neither.*

$$\big((p \vee q) \to q\big) \leftrightarrow (p \to q).$$

Solution.

a) Tautology.

p	q	p ∨ q	p → q	(p ∨ q) → q	((p ∨ q)→ q) ↔ (p → q)
0	0	0	1	1	1
0	1	1	1	1	1
1	0	1	0	0	1
1	1	1	1	1	1

b)

I) ((p → q)∧ (q → r)) → (p → r)

Consider, that p→r = false. In this way p = 1 and r = 0.
So, two cases for q. If q = 0, then p→q is false. If q = 1, then q→r is false.
So, whatever q is, at least one of p→q, q→r is false.

II) We need to show that p→r is true if p→q and q→r are true. Consider, that p→q and q→R are true, but p→q is false. But, from I we know, that if p→r is false then at least one of p→q, q→r is false. So, our assumption is wrong and by contradiction argument is valid.

- *Consider the following argument.*

If I get a wage rise, then I will buy a car.
If I sell my motorcycle, then I will buy a car.
Therefore, if I get a wage rise and I sell my motorcycle, then I will buy a car.

a. *Use symbols to write the logical form of this argument.*
b. *If the argument is valid, prove it is valid; if not, justify why not.*

Solution.

a. if A, then C
   if B, then C
   therefore, if A and B, then C
b. Valid. Consider that premises are true, but conclusion is false(argument is invalid). So, if A is true then C is true. If B is true then C is true. But conclusion says that A is true and B is true and C is false. This is impossible, cause if A or B is true C also is true.
   So, assumption is wrong and by contradioction argument is valid.

- *Prove the following statement is true.*
  For all integers a and b, if a is odd and b is odd, then $a - b$ is even.

Solution.

Consider that a = 2*x+1, b = 2*y+1 – both odd.
Then a–b = 2*x+1 – (2*y+1) = 2*x–2 * y+1–1 = 2* (x-y) – even.

ASSIGNMENTEXPERT DO MY ASSIGNMENT SUBMIT

- *If $x \in R$, either prove that the following statement is true, or else give a counter-example to show that it is false.*

$$\lfloor x \rfloor \lceil x \rceil = \lfloor x - 1 \rfloor \lceil x + 1 \rceil.$$

Solution.

It doesnt work for integers. Ex. x = 4:

⌊x⌋ * ⌈x⌉ = ⌊4⌋ * ⌈4⌉ = 4 * 4 = 16. ⌊x - 1⌋ * ⌈x + 1⌉=⌈4-1⌉ * ⌊4+1⌋ = ⌈3⌉ * ⌊5⌋ = 3*5 = 15

16 = 15, so this statement is false.

WWW.ASSIGNMENTEXPERT.COM