1. Truth Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| p | q | (q→¬p) | ¬p↔¬q­­ | ( q→ ¬p) ∨ (¬ p↔ ¬q) |
| T | T | F | T | T |
| T | F | T | F | T |
| F | T | T | F | T |
| F | F | T | T | T |

1. Express these system specifications using the propositions

P:“The user enters a valid password,”

Q:“Access is granted,”

R:“The user has paid the subscription fee”

* 1. The user has paid the subscription fee but does not enter a valid password.

r ∧¬p

* 1. Access is granted whenever the user has paid the subscription fee and enters a valid password.

(r∧p) →q

* 1. Access won’t be denied unless the user has not paid the subscription fee.

¬r→¬q

* 1. It’s necessary to enter a valid password to have the access granted.

q→ p

1. ( q→ ¬p) ∨ (¬ p↔ ¬q) is a tautology because all its truth values are true: as shown in the last column
2. P(x, y) means “x+2y = xy where x and y are integers
   1. True, At least one element exists to make this true

Example: ∃yP(3,3) would be:

3+2(3) = 3\*3

3+6 = 9

9=9 *is true*

* 1. False

1+2(0)=1(0) 1!= 0 x = 1, y = 0

2+2(0)=2(0) 2!= 0 x = 2, y = 0

Plugging in 0 into y for any x value returns FALSE

* 1. False, plugging in 0 for y in for any x value causes a FALSE outcome in every instance
  2. False if you plug in 0 into any expression with a variable x, the expression will return as FALSE

1. **Prove that if n is an integer, then n is even if and only if 7n + 4 is even**: p<->q

|  |  |  |
| --- | --- | --- |
| step | statements | Explanation |
| 1 | ¬p = “n is odd” | Assume conclusion is false |
| 2 | 7n+4 is even | premise |
| 3 | 7n | Product of two odd integers is odd(1) |
| 4 | 7n+4 is odd | Sum of odd and even integer is odd(3) |
| 5 | ¬p is false, n is even | Contradiction, 7n+4 cannot be even and odd simultaneously  (2) & (4) |

1. Line 7- Incorrect because conjunction uses a ∧ operator.

If done properly it would produce ‘∀xP(x) ∧ ∀xQ(x)’

Line 5 – Incorrect because you take the left value when using simplification, so you cannot take Q(C).