**Example 6**

5. Sue is exactly one of the following: a Computer major or a junior

Use a truth table to establish the following logical equivalences

**( j ∨ c) ∧ ¬ (j ∧ c) ≡ ( j ∧ ¬ c) v ( c ∧ ¬ j)**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **j** | **c** | **j∨ c** | **j∧c** | **¬ (j ∧ c)** | **(j∨c) ∧¬( j ∧c)** | **¬c** | **j∧¬ c** | **¬ j** | **c∧¬ j** | **(j∧¬c) ∨ (c ∧¬j)** |
| T | T | T | T | F | F | F | F | F | F | F |
| T | F | T | F | T | T | T | T | F | F | T |
| F | T | T | F | T | T | F | F | T | T | T |
| F | F | F | F | T | F | T | F | T | F | F |

Let **¬ (j ∧ c) = p**

**( j ∨ c) ∧ p**

**≡ p ∧ ( j ∨ c)**

**≡ ( p ∧ j) ∨ ( p ∧ c )**

**≡ ( ¬ (j ∧ c) ∧ j) ∨ ( ¬ (j ∧ c) ∧ c )**

**≡ ( ( ¬ j ∨ ¬ c) ∧ j) ∨ ( ( ¬ j ∨ ¬ c) ∧ c )**

**≡ ( ¬ j ∧ j ∨ ¬ c ∧ j) ∨ ( ( ¬ j ∧ c ∨ ¬ c ∧ c )**

**≡ ( contradiction ∨ ¬ c ∧ j) ∨ ( ( ¬ j ∧ c ) ∨ contradiction )**

**≡ ( ¬ c ∧ j) ∨ ( ( ¬ j ∧ c ) )** ( p ∨ contradiction **≡ p** identity)