Problem 1

|  |  |  |
| --- | --- | --- |
| p q | ¬(p∨q) | ¬p∧¬q |
| 0 0 | 1 | 1 |
| 0 1 | 0 | 0 |
| 1 0 | 0 | 0 |
| 1 1 | 0 | 0 |

对任意的变元赋值, ¬(p∨q)和¬p∧¬q取值相同, ¬(p∨q)≡¬p∧¬q.

Problem 2

p→(q→r) ≡ p→(¬q∨r) ≡ ¬p∨(¬q∨r) ≡ (¬p∨¬q)∨r ≡ ¬(p∧q)∨r ≡ p∧q→r.

Problem 3

p→(¬q∨r)→s ≡ ¬p∨(¬q∨r)→s ≡ ¬(¬p∨¬q∨r)∨s ≡ ¬(¬(p∧q)∨r)∨s

≡ p∧q∧¬r∨s ≡ (p∧q∧¬r)∨s;

p∧q→¬(r∨s) ≡ ¬(p∧q)∨(r∨s) ≡ ¬p∨¬q∨r∨s ≡ (¬p∨¬q∨r)∨s;

当p=1, q=1, r=0, s=0时, p→(¬q∨r)→s = 1, p∧q→¬(r∨s) = 0.

则p→(¬q∨r)→s和p∧q→¬(r∨s)不是逻辑等价.

Problem 4

((r→p)→q)→(p→q) ≡ ((¬r∨p)→q)→(¬p∨q) ≡ (¬(¬r∨p)∨q)→(¬p∨q)

≡ ¬ (r∧¬p∨q)∨(¬p∨q) ≡ ((¬r∨p)∧¬q)∨(¬p∨q)

≡ ((¬r∨p)∨(¬p∨q))∧¬q∨(¬p∨q) ≡ (¬r∨(p∨¬p)∨q))∧(¬p∨(¬q∨q))

≡ (¬r∨1∨q))∧(¬p∨1) ≡ 1∧1 ≡ 1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| p q r | r→p | (r→p)→q | p→q | ((r→p)→q)→(p→q) |
| 0 0 0 | 1 | 0 | 1 | 1 |
| 0 0 1 | 0 | 1 | 1 | 1 |
| 0 1 0 | 1 | 1 | 1 | 1 |
| 0 1 1 | 0 | 1 | 1 | 1 |
| 1 0 0 | 1 | 0 | 0 | 1 |
| 1 0 1 | 1 | 0 | 0 | 1 |
| 1 1 0 | 1 | 1 | 1 | 1 |
| 1 1 1 | 1 | 1 | 1 | 1 |

则((r→p)→q)→(p→q)是永真式.

Problem 5

9个析取中有6个含¬s, 取¬s=1即s=0, 则至少这6个析取为真,

此时判断p∨¬q, ¬p∨¬r, p∨r, 取p=1, r=0, 此时9个析取可以全部为真.

Problem 6

¬(p↔q) ≡ ¬((p→q)∧(q→p)) ≡ ¬(p→q)∨¬(q→p) ≡ ¬(¬p∨q)∨¬(¬q∨p)

≡ (p∧¬q)∨(¬p∧q) ≡ (p∨¬p∧q)∧(¬q∨¬p∧q) ≡ (p∨q)∧(¬q∨¬p)

¬p↔q ≡ (¬p→q)∧(q→¬p) ≡ (p∨q)∧(¬q∨¬p)

则¬(p↔q)和¬p↔q逻辑等价.

Problem 7

(p∧¬q∧¬r)∨(¬p∧q∧¬r)∨(¬p∧¬q∧r)

在p, q和r中恰有两个为假时此命题为真, 否则为假.

Problem 8

p与q是逻辑等价的, 对任意的变元赋值, p与q取值相同;

q与r是逻辑等价的, 对任意的变元赋值, q与r取值相同;

则对任意的变元赋值, p与r的取值相同, 即p与r是逻辑等价的.