Q1

Q1.1

(c1t1∨c1t2∨c1t3∨…∨c1tn)∧(c2t1∨c2t2∨c2t3∨…∨c2tn)∧…∧(cmt1∨cmt2∨cmt3∨…∨cmtn)

Q1.2

subsets(T, k) = { T’ ⊆T | |T’|<=k} ，逻辑对但形式不符合

Q1.3

subsets(c, t) = { c⊆C | t⊆T(c)} ，逻辑对但形式不符合

Q1.4

subsets(C, k) = { C’ ⊆C | |C’|=k}，不确定

Q2.

We bring in new variables:

* Let x1 = q∧((┐p∧┐r) V (p∧r),
* Let x2 = (┐p∧┐r) V (p∧r),
* Let x3 = ┐p∧┐r,
* Let x4 = p∧r,

Now, we apply them:

* Apply x4⟺ p∧r: (x4 V ┐p) ∧(x4 V ┐r) ∧(┐x4 V p)∧(┐x4 V r)
* Apply x3⟺ ┐p∧┐r: (x3 V p) ∧(x3 V r) ∧(┐x3 V ┐p)∧(┐x3 V ┐r)
* Apply x2⟺ x3 V x4: (x2 V ┐x3) ∧(x2 V ┐x4) ∧(┐x2 V x3 V x4)
* Apply x1⟺ q∧x2: (x1 V ┐q) ∧(x1 V ┐x2) ∧(┐x1 V q)∧(┐x1 V x2)

Thus, the CNF is:

(p V x1)∧(x1 V ┐q)∧(x1 V ┐x2)∧(┐x1 V q)∧(┐x1 V x2)∧(x2 V ┐x3)∧(x2 V ┐x4)∧(┐x2 V x3 V x4)∧(x3 V p)∧(x3 V r)∧(┐x3 V ┐p)∧(┐x3 V ┐r)∧(x4 V ┐p)∧(x4 V ┐r)∧(┐x4 V p)∧(┐x4 V r)

Q3.

* p V (q∧r)

Transform:

p V (q∧r) ≡ (p V q)∧(p V r)

SAT Solver

* If p is True: then formula is always True
* If p is Not True: then formula is True when q is True and r is True

Thus, the formula is ***SATISFIABLE***

* ┐((p∧(p→r))→r)

Transform:

┐((p∧(p→r))→r) ≡ ┐((p∧(┐p V r))→r) ≡ ┐((p∧r))→r) ≡ ┐(┐p V r) ≡p∧┐r

SAT Solver

* If p is True and r is False, then formula is True

Thus, the formula is ***SATISFIABLE***

* ┐(p∧((p→q)→q))

Transform:

┐(p∧((p→q)→q)) ≡ ┐(p∧((┐p V q)→q)) ≡ ┐(p∧(┐(┐p V q) V q)) ≡ ┐((p∧q) V (p∧┐q)) ≡ ┐p

SAT Solver

* If p is False, then formula is True

Thus, the formula is ***SATISFIABLE***

Q4.

The formula can be broken down into these parts:

p1, p2, p3, (┐p1 V q), (┐p2 V ┐q V r), (┐p3 V ┐r), then the graph is:

图表, 折线图

描述已自动生成

Q5.

* Step 1: Initialization

Initially, each term is in its own equivalence class:

{f(g(x))}, {g(f(x))}, {f(g(f(g(y))))}, {x}, {f(y)}, {g(f(x))}, {y}

* Step 2: Apply f(g(x)) = g(f(x))

By the equality f(g(x)) = g(f(x)), merge f(g(x)) with g(f(x)).

We get the following equivalence classes:

{f(g(x)), g(f(x))}, {f(g(f(g(y))))}, {x}, {f(y)}, {y}

* Step 3: Apply f(g(f(g(y)))) = x

By the equality f(g(f(g(y)))) = x, merge f(g(f(g(y)))) with x.

We get the following equivalence classes:

{f(g(x)), g(f(x))}, {f(g(f(g(y)))), x}, {f(y)}, {y}

* Step 4: Apply f(y) = x

By the equality f(y) = x, merge f(y) with x.

We get the following equivalence classes:

{f(g(x)), g(f(x))}, {f(g(f(g(y)))), x, f(y)}, {y}

* Step 5: Analyze g(f(x)) != x

At this stage:

g(f(x)) is in {f(g(x)), g(f(x))} (from Step 2).

x is in {f(g(f(g(y)))), x, f(y)} (from Step 4).

By propagating equivalences:

f(g(x)) = g(f(x)), so g(f(x)) connects to f(g(f(g(y)))).

f(g(f(g(y)))) = x, so equivalence forces g(f(x)) into the same class as x.

This violates the inequality g(f(x)) != x.

* Thus, this formula is ***UNSATISFIABLE***.