Homework4

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Problem 1

1. Not wffs
2. Not wffs
3. Not wffs
4. Wffs
5. Wffs

Problem 2

X is bound and Z is free

The scope of the first ∀x is P and Q

The scope of the second ∀x is R

Problem3

1. f(A,B) means a line connects point A and point B , E(X,Y)means line X and line Y are the same line.

(∀A)(∀B) ( (∀X)(∀Y) ( E(X,f(A,B))∧E(Y,f(A,B)) →E(X,Y) ) )

1. P(X)means X works in Shanghai

Q(X)means X lives in Shanghai

∃X (P(X)∧¬Q(X))

1. P(Y) means date Y is tomorrow and date Y is fine

Q(X) means student X will go swimming

(∀Y) P(Y)→(∃X) Q(X)

Problem 4

任意一个正整数都是有理数而并非所有有理数都是正整数。

Problem 5

1. P(x) means X is not smaller than 2

(∃X)P(X)

2. ((P(a)→Q(a)) ∨ (P(a)→Q(b)) ∨ (P(a)→Q(c))) ∧ ( (P(b)→Q(a)) ∨ (P(b)→Q(b)) ∨ (P(b)→Q(c))) ∧ ((P(c)→Q(a)) ∨ (P(c)→Q(b)) ∨ (P(c)→Q(c)))

= (¬P(a) ∨ Q(a) ∨ Q(b) ∨ Q(c) ) ∧ (¬P(b) ∨ Q(a) ∨ Q(b) ∨ Q(c) ) ∧ (¬P(c) ∨ Q(a) ∨ Q(b) ∨ Q(c))

3. True

False

False

True

True

False

Problem 6

1. (∀x)(P(x) → (∃y)Q(x, y))

=(∀x)(¬P(x) ∨ (∃y)Q(x, y))

=(∀x)(∃y)((¬P(x) ∨ Q(x, y))

=(∀x)(∃y)S(x,y)

(∃x)P(x, y) ↔ (∀z)Q(z)

=(¬(∃x)P(x, y) ∨ (∀z)Q(z)) ∧ ((∃x)P(x, y) ∨ ¬(∀z)Q(z))

=((∀x)¬P(x, y) ∨ (∀z)Q(z)) ∧ ((∃x)P(x, y) ∨ (∃z)¬Q(z))

=(∀x)(∀z)(¬P(x, y) ∨ Q(z)) ∧ (∃x)(P(x, y) ∨ ¬Q(x))

=(∀x)(∀z)(¬P(x, y) ∨ Q(z)) ∧ (∃m)(P(m, y) ∨ ¬Q(m))

=(∀x)(∀z)(∃m)( (¬P(x, y) ∨ Q(z)) ∧ (P(m, y) ∨ ¬Q(m)) )

=(∀x)(∀z)(∃m)S(x,y,z,m)

1. (∀x)(P(x) → (∃y)Q(x, y)) ∨ (∀z)R(z)

=(∀x)(¬(P(x) ∨ ((∃y)Q(x, y)) ∨ (∀z)R(z)))

=(∀x)( ¬P(x) ∨ (∃y)(∀z)(Q(x, y) ∨ R(z)) )

=(∀x)(∃y)(∀z) ( ¬P(x) ∨ Q(x, y) ∨ R(z) )

=(∀x)(∃y)(∀z)M(x,y,z)

=(∀x)(∀z)M(x,f(x),z)

(∃y)(∀x)(∀z)(∃u)(∀v)P(x, y, z, u, v)

=(∀x)(∀z)(∀v)P(x, a, z, f(x,z), v)

Problem 7

P = true Q =true

It will not return unsat

当改变一个变元的真值后使得profits为5时返回sat

Problem 8

∅ || 1 ∨ 2, 1 ∨ 2, 2 ∨ 3, 3 ∨ 4, 1 ∨ 4

1 ||1 ∨ 2, 1 ∨ 2, 2 ∨ 3, 3 ∨ 4, 1 ∨ 4

1 2 4 ||1 ∨ 2, 1 ∨ 2, 2 ∨ 3, 3 ∨ 4, 1 ∨ 4

1 2 4 3 ||1 ∨ 2, 1 ∨ 2, 2 ∨ 3, 3 ∨ 4, 1 ∨ 4 3 ∨ 4 not profit

1 ||1 ∨ 2, 1 ∨ 2, 2 ∨ 3, 3 ∨ 4, 1 ∨ 4

1 2 ||1 ∨ 2, 1 ∨ 2, 2 ∨ 3, 3 ∨ 4, 1 ∨ 4

12 3 ||1 ∨ 2, 1 ∨ 2, 2 ∨ 3, 3 ∨ 4, 1 ∨ 4

1 2 3 4 ||1 ∨ 2, 1 ∨ 2, 2 ∨ 3, 3 ∨ 4, 1 ∨ 4 profit