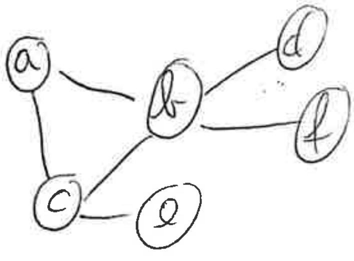

$a = b-2$
$c = a+3$
$e = c+1$
$b = 2f+1$
$d = b-1$
$c = b+1$

$D_v = \{1,2,3,4,5\} \quad \forall v$

$M = \{\cancel{(a,b)}, \cancel{(a,c)}, \cancel{(b,a)}, \cancel{(b,c)}, \cancel{(b,d)}, \cancel{(b,f)}, \cancel{(c,a)}, \cancel{(c,b)}, \cancel{(c,e)}, \cancel{(d,b)}, \cancel{(e,c)}, \cancel{(f,b)}\}$
$\cancel{(a,b)}, \cancel{(b,c)}, \cancel{(a,c)}, (c,a).$

1) (a,b) ; $a = b-2$; $D_a = \{1,2,3\}$, changed.
Other $(*,a)$? Yes, but already in M. Nothing to do (NTD)

2) (a,c) $a = c-3$ $D_a = \{1,2\}$, changed.
Other $(*,a)$? Yes, but already in M. NTD.

3) (b,a) ; $b = a+2$; $D_b = \{3,4\}$, changed.
Other $(*,b)$? Yes, but already in M. NTD.

4) (b,c) ; $b = c-1$; $D_b = \{3,4\}$, no change -> NTD.

5) (b,d) ; $b = d+1$ $D_b = \{3,4\}$, no change -> NTD.

6) (b,f); $b = 2f+1$ $\boxed{D_b = \{3\}}$, changed.
Other $(*,b)$? Yes, we add (a,b) in M

7) (c,a) ; $c = a+3$; $D_c = \{4,5\}$, changed.
Other $(*,c)$? Yes, we add (b,c) in M

8) (c,b) ; $c = b+1$; $\boxed{D_c = 4}$, changed.
Other $(*,c)$? Yes, we add (a,c) in M

9) (c,e) ; $c = e-1$; $D_c = 4$, no change -> NTD

10) (d,b) ; $d = b-1$; $\boxed{D_d = 2}$, changed!
Other $(*,d)$? No -> NTD

; $\boxed{D_e = \{5\}}$, changed.

→ NTD

; $\boxed{D_f = \{1\}}$; changed.

NTD

; $\boxed{D_a = \{1\}}$; changed.

add (c,a) in M

; $D_b = 3$, no change → NTD

; $D_a = \{1\}$, no change → NTD

$+3$; $D_c = \{4\}$; no change → NTD

Printer(x) Stapler(x) Alex

Noisy(x)

Manager(x)

Has(x, y)

1) $\forall x \; Printer(x) \Rightarrow Noisy(x)$

2) $\forall x \forall y \; [(Has(x,y) \wedge Stapler(y)) \Rightarrow \neg \exists z (Has(x,z) \wedge Dispenser(z))]$

3) $\forall x \; Manager(x) \Rightarrow \neg \exists y \; [Has(x,y) \wedge Noisy(y)]$

4) $\exists x \; [Has(alex, x) \wedge [Stapler(x) \vee Printer(x)]]$

Th) $Manager(alex) \Rightarrow \neg \exists x \; [Has(Alex, x) \wedge Dispenser(x)]$

¬Th) $\neg(Manager(alex) \Rightarrow \neg \exists x \; [Has(alex, x) \wedge Dispenser(x)])$

1) $\neg Printer(x) \vee Noisy(x)$

2) $\forall x \forall y \; [(Has(x,y) \wedge Stapler(y)) \Rightarrow \forall z \; \neg (Has(x,z) \wedge Dispenser(z))]$

$\forall x \forall y \forall z$

$[\neg (Has(x,y) \wedge Stapler(y)) \vee \neg Has(x,z) \vee \neg Dispenser(z)]$

$\neg Has(x,y) \vee \neg Stapler(y) \vee \neg Has(x,z) \vee \neg Dispenser(z)$

3) $\forall x \forall y \; [\neg Manager(x) \vee \neg Has(x,y) \vee \neg Noisy(y)]$

$\neg Manager(x) \vee \neg Has(x,y) \vee \neg Noisy(y)$

4) $Has(alex, a) \wedge [Stapler(a) \vee Printer(a)]$

4a) $Has(alex, a)$

4b) $Stapler(a) \vee Printer(a)$

~~5) $\neg(Manager(alex) \Rightarrow \forall x \; \neg [Has(alex, x) \wedge Dispenser(x)])$~~

5) $\neg [\neg Manager(alex) \vee \neg \exists x \; [Has(alex, x) \wedge Dispenser(x)]]$

$Manager(alex) \wedge \exists x \; (Has(alex, x) \wedge Dispenser(x))$

5a) $Manager(alex)$ 5b) $Has(alex, b)$ 5c) $Dispenser(b)$

5c e 2) $\sigma = \{z/b)$ $\neg Has(x,y) \vee \neg Stapler(y) \vee \neg Has(x,b)$ 6

6 e 5b) $\sigma = \{x/Alex\}$ $\neg Has(Alex, y) \vee \neg Stapler(y)$ 7

7 e 4a) $\sigma = \{y/a)$ $\neg Stapler(a)$ 8

8 e 4b) $Purple(a)$ 9

9 e 1) $\sigma = \{x/a\}$ $Navy(a)$ 10

10 e 3) $\sigma = \{y/a\}$ $\neg Manager(x) \vee \neg Has(x,a)$ 11

11 e 4a) $\sigma = \{x/Alex\}$ $\neg Manager(Alex)$ 12

12 e 5a) $\{\}$

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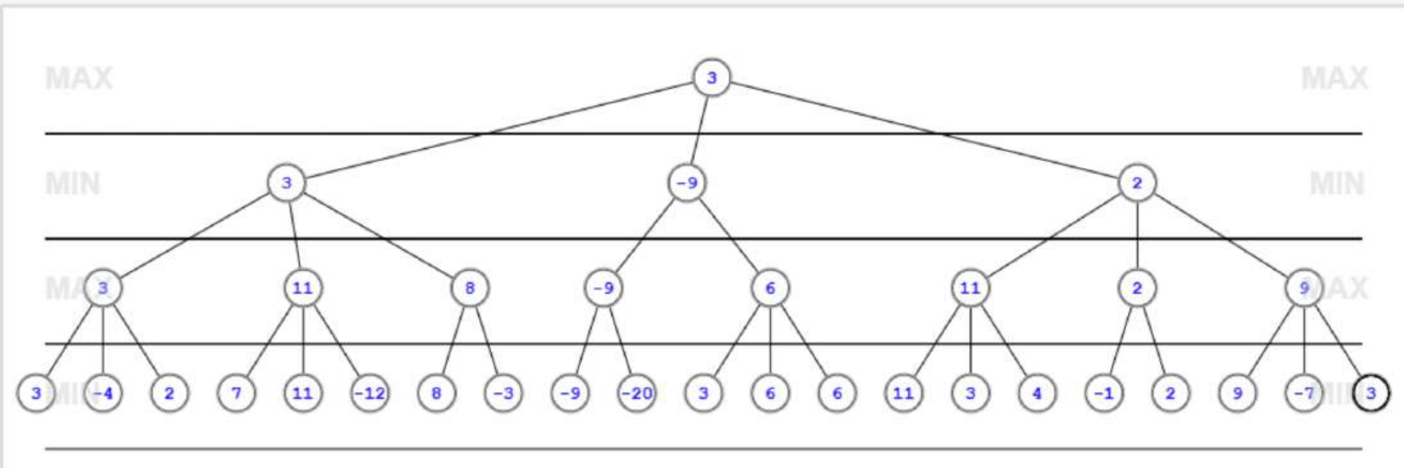
1) $P(x, f(x)) \Rightarrow Q(z, f(x))$

2) $R(y, f(y)) \wedge \neg S(a, y)$

3) $P(x, y, f(x,y)) \vee Q(g(x,y), y)$

4) $P(z) \Rightarrow Q(a, b, f(z))$



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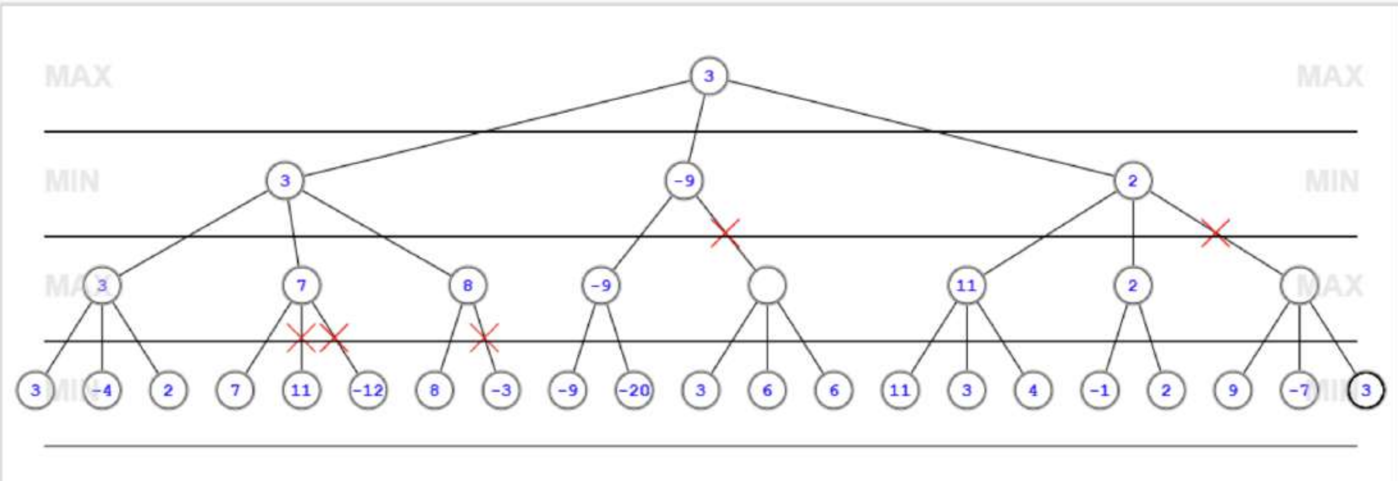

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