1. $A = q \rightarrow \neg p \vee \neg q \wedge r$

q	p	r	A
T	T	T	F
T	T	F	F
T	F	T	T
T	F	F	T
F	T	T	T
F	T	F	T
F	F	T	T
F	F	F	T

2. $(\neg(\neg r \wedge p) \rightarrow q) \rightarrow \neg r$

$\equiv \neg(\neg(\neg r \wedge p) \rightarrow q) \vee \neg r$

$\equiv \neg((\neg r \wedge p) \vee q) \vee \neg r$

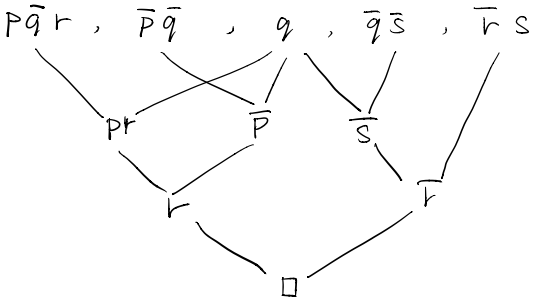
$\equiv (\neg(\neg r \wedge p) \wedge \neg q) \vee \neg r$

$\equiv ((r \vee \neg p) \wedge \neg q) \vee \neg r$

$\equiv (r \vee \neg p \vee \neg r) \wedge (\neg q \vee \neg r)$

$\equiv \neg p \wedge (\neg q \vee \neg r)$

3.



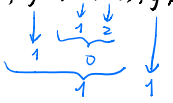
4. p : arity 2
q : arity 1
f : arity 2
a : constant

i : TRUE
h : FALSE

$\langle \{0,1,2\}, \{P, Q\}, \{F\}, \{1\} \rangle$

$\sigma(x) = 2$, $\sigma(y) = 1$

(a) $\mathcal{D}_{\mathcal{I},\sigma}(f(f(y, f(a,x)), y)) = 2$



(b) $\mathcal{N}_{\mathcal{I},\sigma}(p(x,y) \vee q(a) \rightarrow \neg q(f(x,y))) = i$

(c) $\mathcal{V}_{I,\sigma}(\forall y P(y,x) \to \neg q(f(y,y)))$

$\mathcal{V}_{I,\sigma}(\forall y P(y,x)) = i$, $\forall y \in \{0,1,2\}: y = 0,1 \Rightarrow \mathcal{V}_{I,\sigma}(\text{original}) = h$

$\mathcal{V}_{I,\sigma}(\forall y P(y,x)) = h$, $\forall y \in \{0,1,2\}: y = 2 \Rightarrow \mathcal{V}_{I,\sigma}(\text{original}) = i$

5. $f(n) = 3^n + 2n^3$ $\quad g(n) = n^2 3^n + n^3 2^n$ $\quad h(n) = (n^2+n)3^n$

(1) $\frac{f(n)}{g(n)} = \frac{3^n + 2n^3}{n^2 3^n + n^3 2^n} = \frac{1 + 2n^3/3^n}{n^2 + n^3 2^n/3^n} \to 0$

So. $f(n) = O(g(n)) \iff f(n) \neq \Omega(g(n))$

(2) $\frac{g(n)}{f(n)} \to +\infty$

So, $g(n) = \Omega(f(n))$ is correct!

(3) $\frac{g(n)}{h(n)} = \frac{n^2 \cdot 3^n + n^3 \cdot 2^n}{(n^2+n)3^n} = \frac{n^2 + n^3 \cdot 2^n/3^n}{n^2+n} = \frac{1 + n \cdot 2^n/3^n}{1 + 1/n} \to 1$

so. $g(n) = \Theta(h(n)) \Rightarrow g(n) \neq O(h(n))$

(4) $\frac{h(n)}{g(n)} \to 1$

so, $h(n) = \Theta(g(n)) \Rightarrow h(n) \neq O(g(n))$

6. TM : $L = \{u \in \{a,b,c\}^* \mid$ the last letter of u occurs no more in $u\}$.