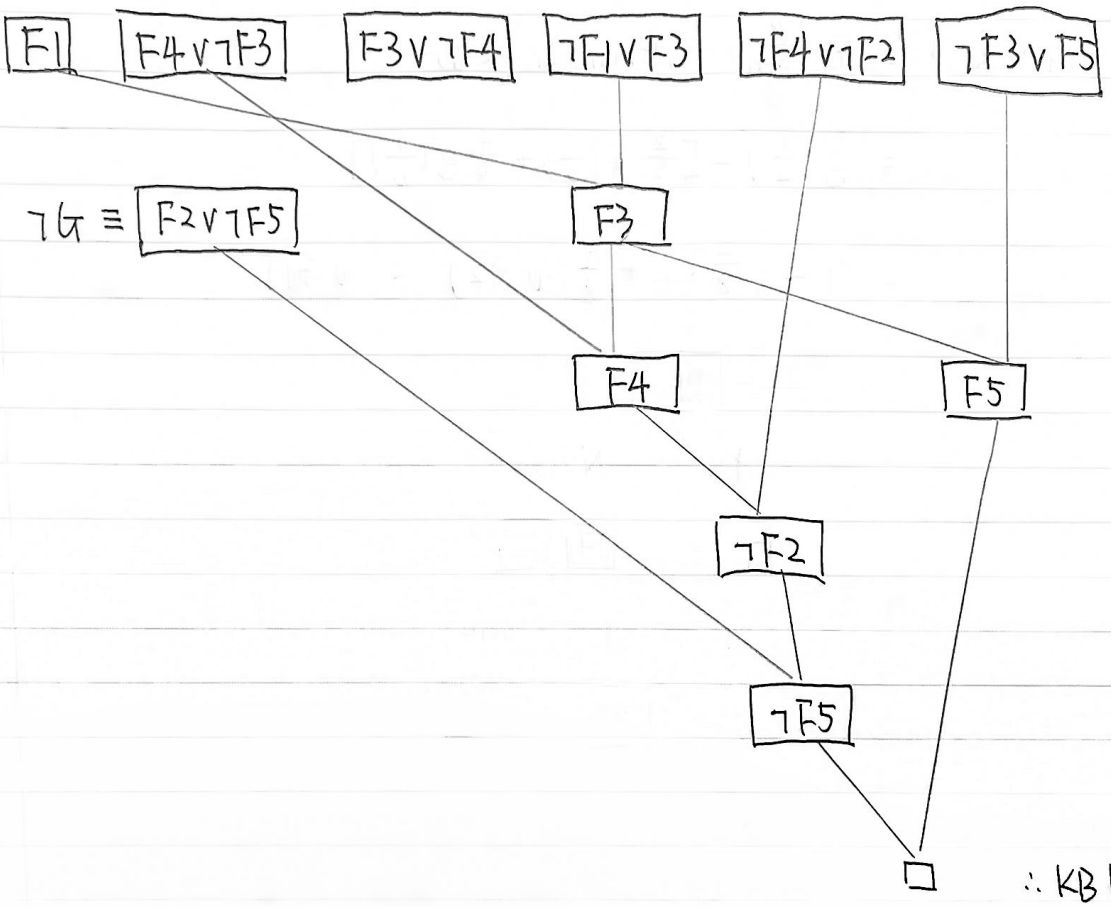
Homework 4

1) Proof by truth table enumeration
   Proof by resolution

2) $(\neg F4 \Leftrightarrow \neg F3) \equiv (\neg F4 \Rightarrow \neg F3) \wedge (\neg F3 \Rightarrow \neg F4)$
   $\equiv (F4 \vee \neg F3) \wedge (F3 \vee \neg F4)$



∴ KB ⊨ G

3) $\text{Gain}(\text{Hun}) = B\left(\frac{p}{p+n}\right) - \text{Remainder}(\text{Hun})$

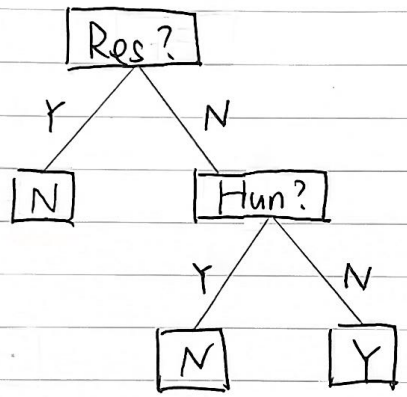
$= B\left(\frac{4}{8}\right) - \left[\frac{3}{8} B\left(\frac{1}{3}\right) + \frac{5}{8} B\left(\frac{3}{5}\right)\right]$

$\approx 1 - \left(\frac{3}{8} \cdot 0.92 + \frac{5}{8} \cdot 0.97\right) \approx 0.049$

$\text{Gain}(\text{Res}) = B\left(\frac{p}{p+n}\right) - \text{Remainder}(\text{Res})$

$= B\left(\frac{1}{2}\right) - \left[\frac{2}{8} B\left(\frac{0}{2}\right) + \frac{6}{8} B\left(\frac{4}{6}\right)\right]$

$\approx 1 - \left(\frac{2}{8} \cdot 0 + \frac{6}{8} \cdot 0.92\right) \approx 0.311$



4) $a_5 = \text{ReLu}(0.1 \cdot a_1 + 0.1 a_2) = \text{ReLu}(0.25) = 0.25$

$a_6 = \text{ReLu}(0.1\, a_3 + 0.1 a_4) = \text{ReLu}(-0.45) = 0$

$a_7 = S(0.2 a_5 + 0.2 a_6) = S(0.05) \approx 0.512$

5) $Err_7 = 1.0 - 0.512 = 0.488$

$\Delta_7 = Err_7 \cdot g'(in_7) = 0.488\, g'(0.05) = 0.488\, g(0.05)(1 - g(0.05))$

≈ 0.122

$W_{57} + \alpha \cdot \Delta_7 \cdot a_5 = 0.2 + 0.1 \cdot 0.122 \cdot 0.25 = 0.20305$

$W_{67} + \alpha\, \Delta_7 \cdot a_6 = 0.2 + 0.1 \cdot 0.122 \cdot 0 = 0.2$

$\Delta_5 = g'(in_5)(W_{57} \cdot \Delta_7) = ReLu'(0.25) \cdot 0.2 \cdot 0.122$

$= 1 \cdot 0.2 \cdot 0.122 = 0.0244$

$\Delta_6 = g'(in_6)(W_{67} \cdot \Delta_7) = ReLu'(-0.45) \cdot 0.2 \cdot 0.122 = 0$

$W_{15} + \alpha \cdot \Delta_5 \cdot a_1 = 0.1 + 0.1 \cdot 0.0244 \cdot 1.0 = 0.10244$

$W_{25} + \alpha \cdot \Delta_5 \cdot a_2 = 0.1 + 0.1 \cdot 0.0244 \cdot 1.5 = 0.10366$

$W_{36} + \alpha \cdot \Delta_6 \cdot a_3 = 0.1 + 0 = 0.1$

$W_{46} + \alpha \cdot \Delta_6 \cdot a_4 = 0.1 + 0 = 0.1$

New Weights:

$W_{15} = 0.10244$	$W_{25} = 0.10366$
$W_{36} = 0.1$	$W_{46} = 0.1$
$W_{57} = 0.20305$	$W_{67} = 0.2$

6) (a) $5^2 = 25$

(b) $124^2 \cdot 25 = 384400$

(c) 60×60

(d) $32^2 \cdot 32^2 = 1048576$