Problem 1:

Suppose $P(t=k|x) \geq P(t=j|x)$,

$$\frac{P(x|t=k)P(t=k)}{P(x)} \geq \frac{P(x|t=j)P(t=j)}{P(x)}$$

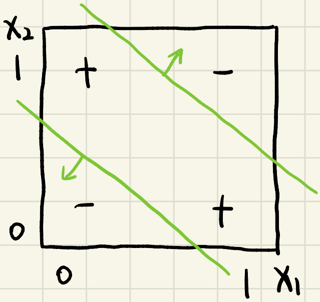
$$P(x|t=k)P(t=k) \geq P(x|t=j)P(t=j)$$

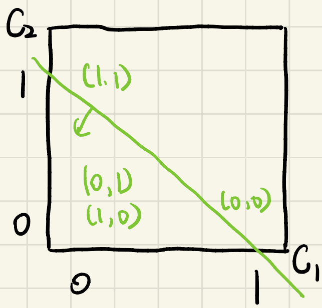
$$\pi_k \prod_{i=1}^{d} P_{k,i}^{x_i}(1-P_{k,i})^{1-x_i} \geq \pi_j \prod_{i=1}^{d} P_{j,i}^{x_i}(1-P_{j,i})^{1-x_i}$$

$$\log \pi_k + \sum_{i=1}^{d}[x_i \log P_{k,i} + (1-x_i)\log(1-P_{k,i})]$$
$$\geq \log \pi_j + \sum_{i=1}^{d}[x_i \cdot \log P_{j,i} + (1-x_i)\log(1-P_{j,i})]$$

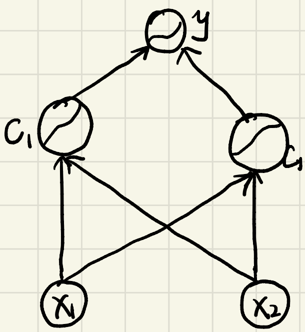
Thus, the decision boundary is linear.

Problem 2:





Point:	(0, 0)	(0, 1)	(1, 0)	(1, 1)
Classifier 1:	1	0	0	0
Classifier 2:	0	0	0	1



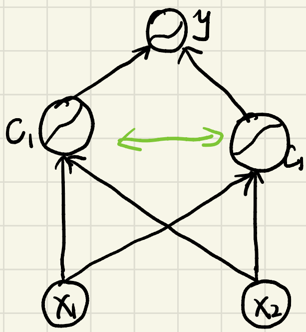
$$y = \frac{1}{1+e^{-(w_0+w_1C_1+w_2C_2)}}$$

$$= \frac{1}{1+e^{-\left(w_0+w_1\left\{\frac{1}{1+e^{-(w_{1,0}+w_{1,1}x_1+w_{1,2}x_2)}}\right\}+w_2\left\{\frac{1}{1+e^{-(w_{2,0}+w_{2,1}x_1+w_{2,2}x_2)}}\right\}\right)}}$$

Parameter: $w_{1,0}$, $w_{1,1}$, $w_{1,2}$, $w_{2,0}$, $w_{2,1}$, $w_{2,2}$

Problem 3:

Switch two nodes.



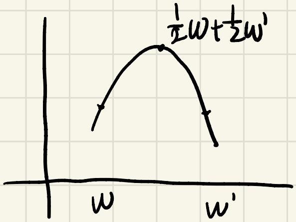
change two classifiers

Suppose there are two weight w and w' (after change),

$J(w)$ and $J(w')$ are small.

Choose $\lambda = \frac{1}{2}$, and get $J(\frac{1}{2}w + \frac{1}{2}w')$.

$J(\frac{1}{2}w + \frac{1}{2}w')$ is bigger than $J(w)$ and $J(w')$ because $J(\frac{1}{2}w + \frac{1}{2}w')$ has two neurons but $J(w)$ and $J(w')$ only have one.



Thus, it's not convex.