10-601
HW3
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1)

a) DT: C

LR: A & B

Perceptron: A

NN: A B C

b)

| | DT | LR | Perceptron | NN |
|---|---|---|---|---|
| Logic OR | yes<br>no full tree | yes | yes | yes |
| Logic XOR | yes<br>full tree | no | no | yes |
| Majority | yes<br>no full tree | no | no | no |
| Parity | yes<br>full tree | no | no | yes |

2) $\text{Loss}(w) = -y \ln p - (1-y) \ln (1-p)$

$= -y \ln\left(\frac{e^z - e^{-z}}{e^z + e^{-z}}\right) - (1-y) \ln\left(\frac{e^z + e^{-z} - e^z + e^{-z}}{e^z + e^{-z}}\right)$

$= -y \ln (e^z - e^{-z}) + y \ln (e^z + e^{-z}) - (1-y) \ln (2e^{-z}) + (1-y) \ln (e^z + e^{-z})$

$= -y \ln (e^z - e^{-z}) + \ln (e^z + e^{-z}) + (y+1) \ln (2e^{-z})$

$\frac{\partial}{\partial w} = -y \ln (e^z - e^{-z}) + \ln (e^z + e^{-z}) + (y+1) z (\ln(2))$

$0 = -y \frac{e^{2w^T x} + 1}{e^{2w^T x} - 1} + \frac{e^{2w^T x} - 1}{e^{2w^T x} + 1} + w^T$

$0 = -y \frac{1}{\tanh(2w^T x)} + \tanh(2w^T x) + w^T$

$w = 0$