

11. CIRCUITS

$$y(x_1, x_2, x_3, x_4, x_5) = x_1x_2 + x_1x_3 + x_1x_4 + x_1x_5 + x_2x_3 \\ + x_2x_4 + x_2x_5 + x_3x_4 + x_3x_5 + x_4x_5$$

○ y

○
 x_1

○
 x_2

○
 x_3

○
 x_4

○
 x_5

circuits

$$y(x_1, x_2, x_3, x_4, x_5) = x_1x_2 + x_1x_3 + x_1x_4 + x_1x_5 + x_2x_3 \\ + x_2x_4 + x_2x_5 + x_3x_4 + x_3x_5 + x_4x_5$$

○ y

○
 x_1

○
 x_2

○
 x_3

○
 x_4

○
 x_5

$$y(x_1, \dots, x_{20}) = \sum_{|S|=10} \prod_{i \in S} x_i$$

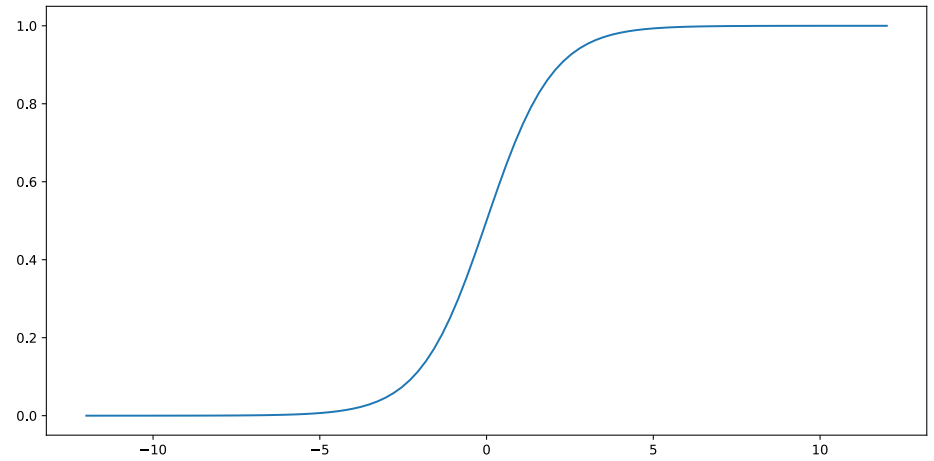
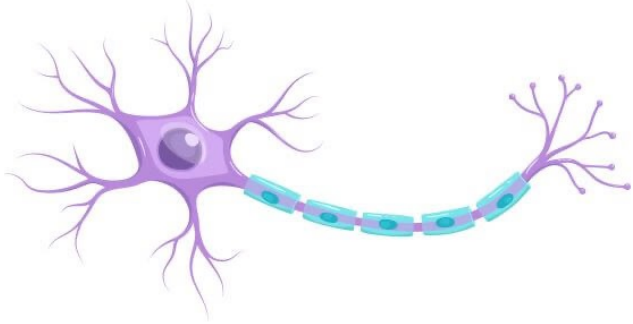
$$= x_1 x_2 \dots x_9 x_{10} + x_1 x_2 \dots x_9 x_{11} + x_{11} x_{12} \dots x_{20}$$

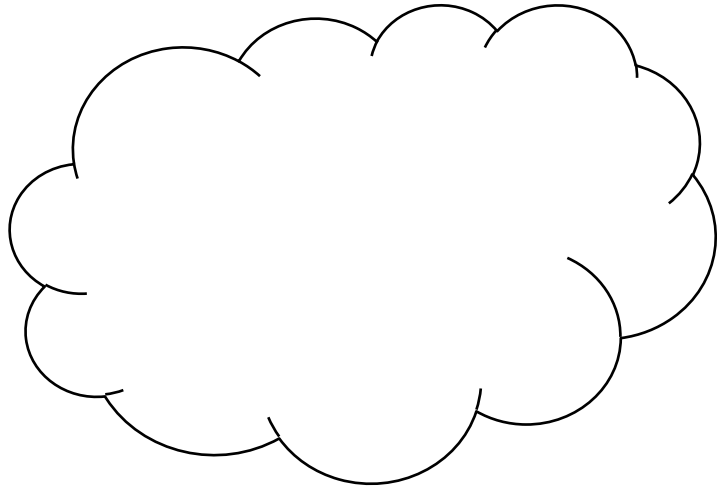
$$\begin{aligned}c_0 &= 2965638101/5518098432000 \\c_1 &= -46937467057/4828336128000 \\c_2 &= 1623151366349/19313344512000 \\c_3 &= -742866335297/1609445376000 \\c_4 &= 23244571515317/12875563008000 \\c_5 &= -716646421081/134120448000 \\c_6 &= 19976964872357/1609445376000 \\c_7 &= -443829136609/19160064000 \\c_8 &= 226997057727689/6437781504000 \\c_9 &= -106692491681983/2414168064000\end{aligned}$$

$$\begin{aligned}c_{10} &= 40247351792213/877879296000 \\c_{11} &= -95170162303973/2414168064000 \\c_{12} &= 180520357853249/6437781504000 \\c_{13} &= -6601198952479/402361344000 \\c_{14} &= 199696061419/25546752000 \\c_{15} &= -1201368202553/402361344000 \\c_{16} &= 425713023751/476872704000 \\c_{17} &= -324027306227/1609445376000 \\c_{18} &= 622171058989/19313344512000 \\c_{19} &= -15743145547/4828336128000 \\c_{20} &= 6063698587/38626689024000\end{aligned}$$

parallel time

perceptrons





x_1

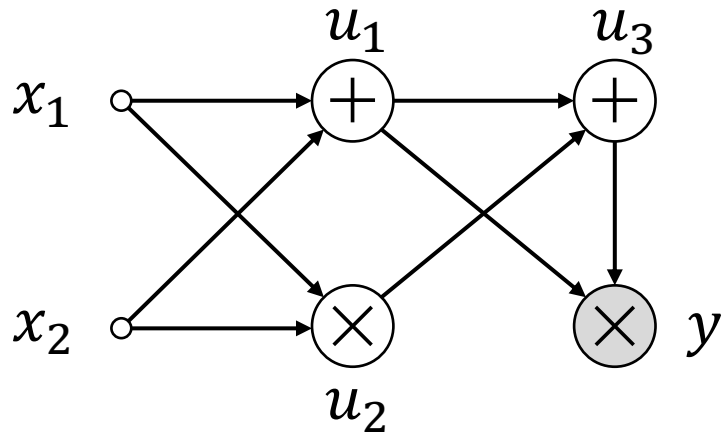
x_2

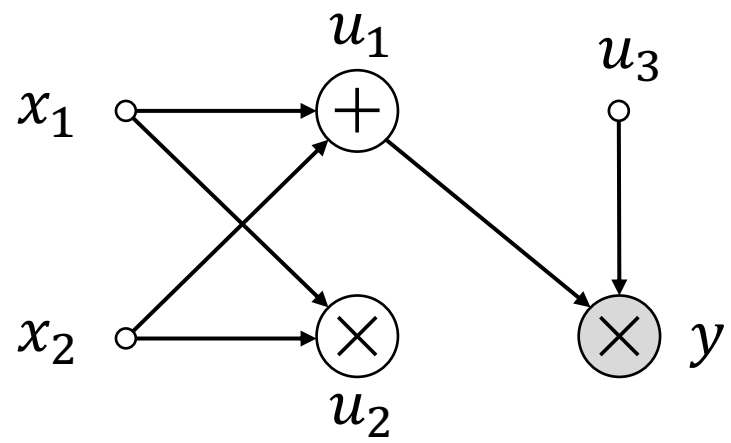
x_3

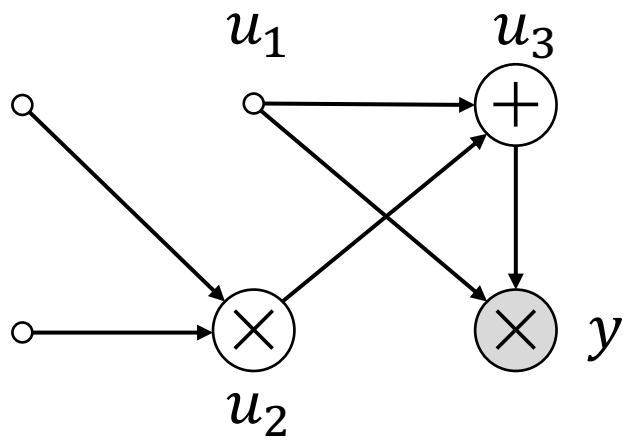
training

gradient descent

derivatives in circuits







chain rule and backpropagation

