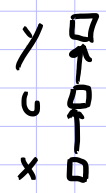
Lecture 20: 4/3/17

Background: Chain Rule of Calculus

Def #1:

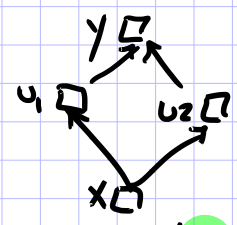
$y = f(u)$
$u = g(x)$



$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$

Def #2:

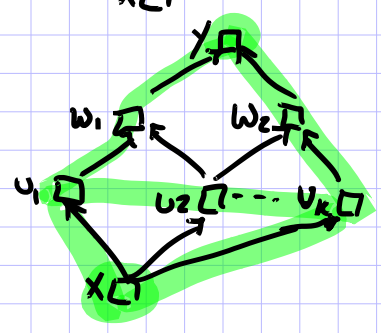
$y = f(u_1, u_2)$
$u_1 = g_1(x)$
$u_2 = g_2(x)$



$$\frac{dy}{dx} = \frac{dy}{du_1}\frac{du_1}{dx} + \frac{dy}{du_2}\frac{du_2}{dx}$$

Def #3:

$y = f(\vec{u})$
$\vec{u} = g(x)$



$$\frac{dy}{dx} = \sum_{j=1}^{K} \frac{dy}{du_j}\frac{du_j}{dx}$$

★ Holds for any intermediate terms $\vec{u}$

Backprop Ex#1

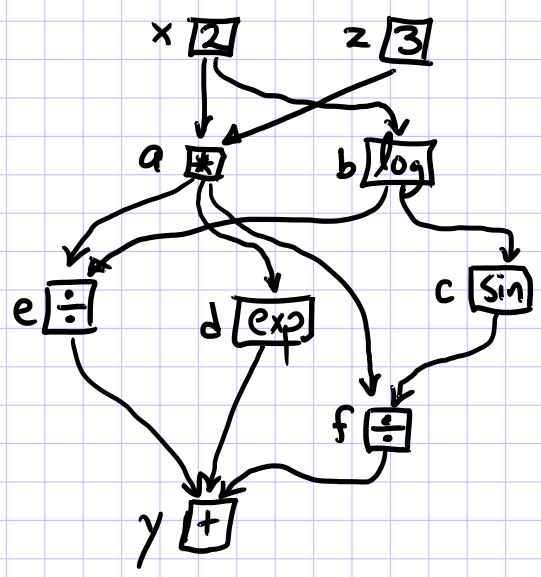
$$y = f(x,z) = \exp(xz) + \frac{xz}{\log(x)} + \frac{\sin(\log(x))}{xz}$$

Forward Computation:

Given $x = 2$, $z = 3$.

$a = xz$
$b = \log(x)$
$c = \sin(b)$
$d = \exp(a)$
$e = a/b$
$f = c/a$
$y = d + e + f$

Computation Graph:



$\frac{dy}{dx}$ $\frac{dy}{dz}$