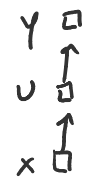
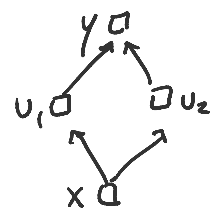
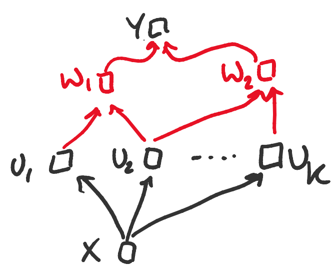
Section A

Friday, February 24, 2023 9:28 AM

Chain Rule

		Computation Graph	Def
Def #1:	$y = f(u)$, $u = g(x)$		$\frac{\partial y}{\partial x} = \frac{\partial y}{\partial u}\frac{\partial u}{\partial x}$
Def #2:	$y = f(u_1, u_2)$, $u_2 = g_2(x)$, $u_1 = g_1(x)$		$\frac{\partial y}{\partial x} = \frac{\partial y}{\partial u_1}\frac{\partial u_1}{\partial x} + \frac{\partial y}{\partial u_2}\frac{\partial u_2}{\partial x}$
Def #3:	$y = f(\vec{u})$, $\vec{u} = g(x)$		$\frac{\partial y}{\partial x} = \sum_{k=1}^{K} \frac{\partial y}{\partial u_k}\frac{\partial u_k}{\partial x}$

Q: Does this still hold?

A: Yes!

Backprop Ex #1

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

Forward Computation

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

$a = xz$

$b = \log(x)$

$c = \sin(b)$

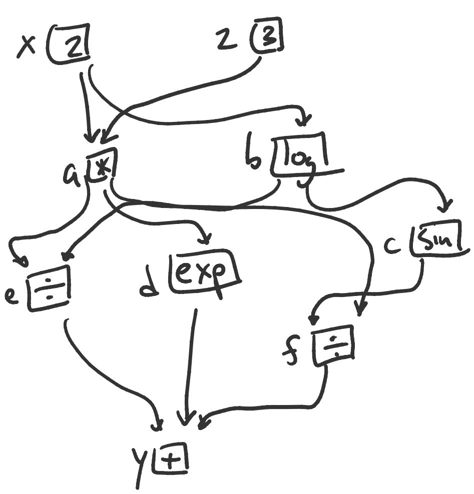
$d = \exp(a)$

$e = a/b$

$f = c/a$

$y = d + e + f$

Computation Graph



Backward Computation

$g_y = \frac{\partial y}{\partial y} = 1$

$g_f = \frac{\partial y}{\partial f}$

$g_e = \frac{\partial y}{\partial e}$

⋮

$g_a = \frac{\partial y}{\partial a}$

$J = y/a$

$y = d + e + f$

$y\boxed{+}$

$g_a = \frac{\partial y}{\partial a}$

$g_x = \frac{\partial y}{\partial x}$

$g_z = \frac{\partial y}{\partial z}$