Side Quest: Computational Graphs

Visualization trick/tool

- → these come in handy when there is some distinguished or some special output variable,
  - → * handy in visualizing components of a much complex equation that you're trying to optimize.
  - → you can visualize each component to find bottlenecks!

$$J(a,b,c) = 3(a+\underbrace{\underbrace{\underbrace{bc}_{u}}_{v}}_{J})$$

assume

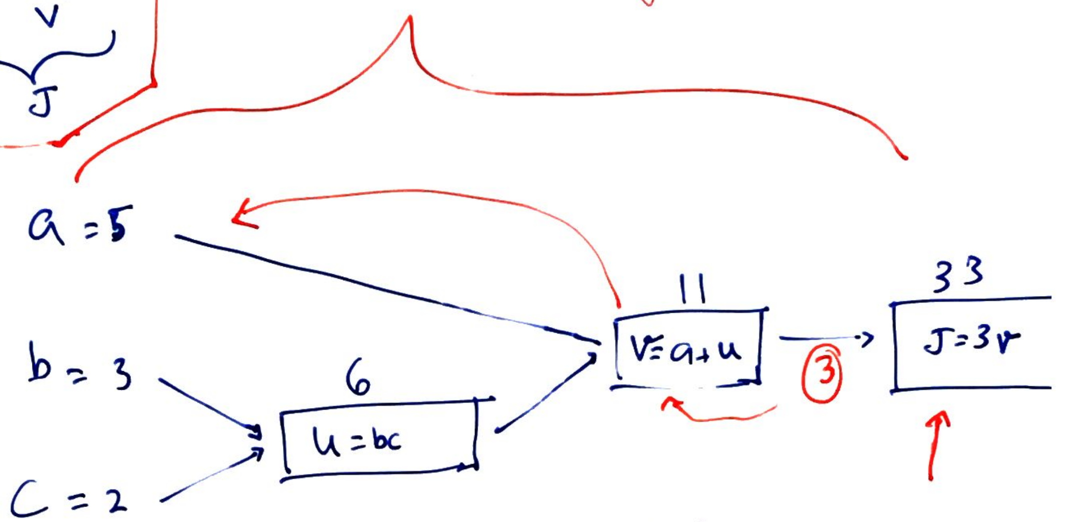
$$= 3(5+3x) = 33$$

Computational graph

$u = bc$

$v = a + u$

$J = 3v$



for computing derivatives we move R to L

$J = 3v$

① $\frac{dJ}{dv} = ? \rightarrow = 3$

② $\frac{dJ}{da} = a?$

If we bump up a, whats effect on J?

$a = 5 \rightarrow 5.001$

$v = 11 \rightarrow 11.001$

$J = 33 \rightarrow 33.003$

$a \xrightarrow{\Delta} 0.001 \quad J \xrightarrow{\Delta} 0.003$

$$\frac{dJ}{da} = 3$$

③ $\frac{dJ}{du} = ?$

$u = 6 \rightarrow 6.001$

$v = 11 \rightarrow 11.001$

$J = 33 \rightarrow 33.003$

$\Rightarrow \frac{dJ}{du} = 3$

i.e. $\underbrace{\frac{dJ}{dv}}_{3} \cdot \underbrace{\frac{dv}{du}}_{1}$

④ $\frac{dJ}{db} = \frac{dJ}{du} \cdot \frac{du}{db}$

$b = 3 \rightarrow 3.001$

$u = b.c = 6 \rightarrow 6.002$ $\boxed{c=2}$

$v = 11.002$

$J = 33.006$

$\frac{dJ}{db} = 6$

Tldr: forward L→R ⇒ compute cost fⁿ

backward R→L ⇒ compute derivati