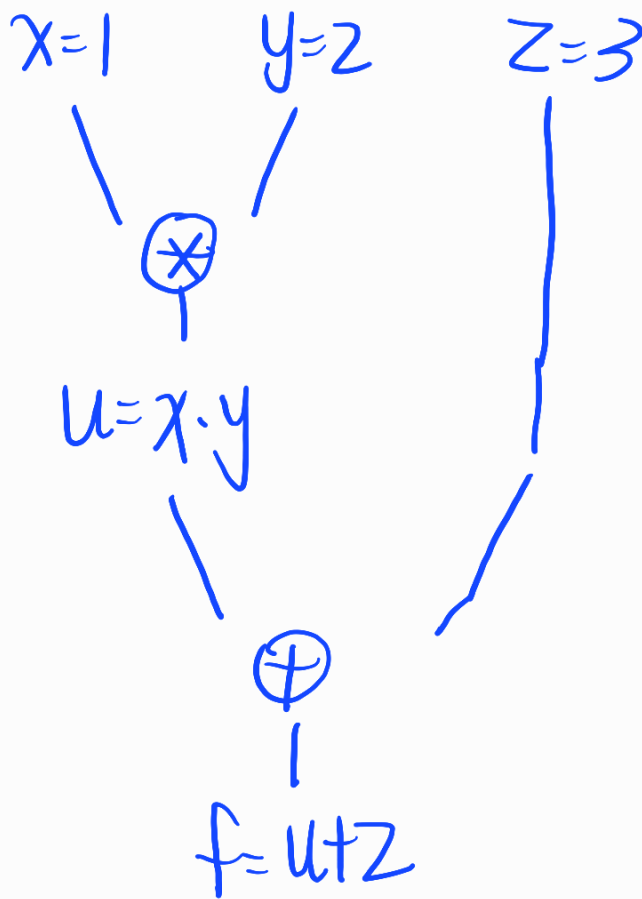


第一題

$$f(x, y, z) = (x \cdot y) + z \quad x=1, y=2, z=3$$

1. 計算圖



2. 正向傳遞

$$u = x \cdot y = 1 \cdot 2 = 2$$

$$f = u + z = 2 + 3 = 5$$

3. 反向傳遞

$$\frac{\partial f}{\partial u} = 1, \frac{\partial f}{\partial z} = 1, \frac{\partial u}{\partial x} = y = 2, \frac{\partial u}{\partial y} = x = 1$$

$$\frac{\partial f}{\partial x} = \frac{\partial f}{\partial u} \cdot \frac{\partial u}{\partial x} = 1 \cdot 2 = 2$$

$$\frac{\partial f}{\partial y} = \frac{\partial f}{\partial u} \cdot \frac{\partial u}{\partial y} = 1 \cdot 1 = 1$$

$$\frac{\partial f}{\partial z} = 1$$

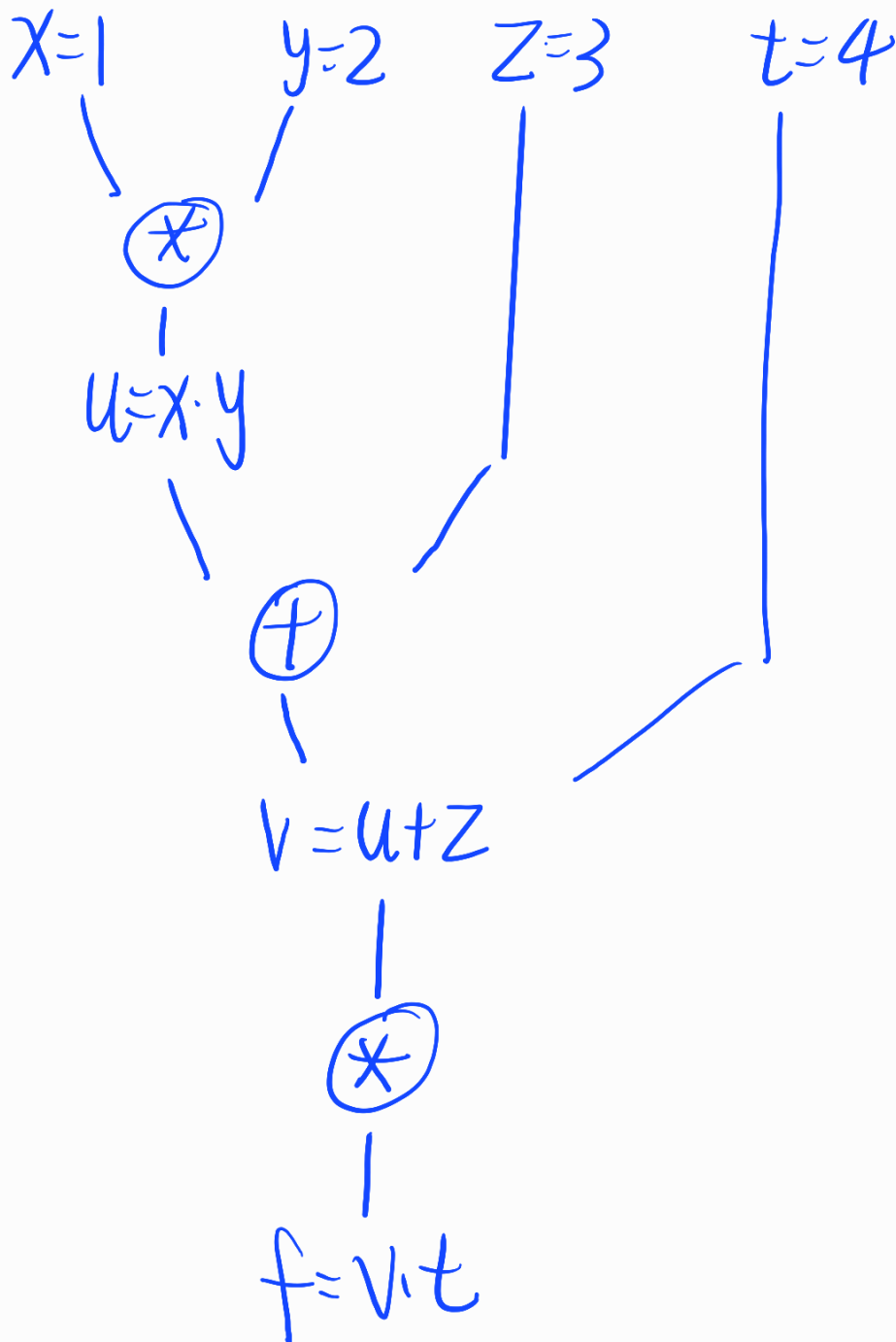
$$\text{梯度: } \frac{\partial f}{\partial x} = 2, \frac{\partial f}{\partial y} = 1, \frac{\partial f}{\partial z} = 1$$

第二題

$$f(x, y, z, t) = ((x \cdot y) + z) \cdot t$$

$$x=1, y=2, z=3, t=4$$

1. 計算圖



2. 正向傳遞

$$u = x \cdot y = 1 \cdot 2 = 2$$

$$v = u + z = 2 + 3 = 5$$

$$f = v \cdot t = 5 \cdot 4 = 20$$

3. 反向傳遞

$$\frac{\partial f}{\partial v} = t = 4, \quad \frac{\partial f}{\partial t} = v = 5, \quad \frac{\partial v}{\partial u} = 1, \quad \frac{\partial v}{\partial z} = 1$$

$$\frac{\partial u}{\partial x} = y = 2, \quad \frac{\partial u}{\partial y} = x = 1$$

$$\frac{\partial f}{\partial u} = \frac{\partial f}{\partial v} \cdot \frac{\partial v}{\partial u} = 4 \cdot 1 = 4$$

$$\frac{\partial f}{\partial x} = \frac{\partial f}{\partial u} \cdot \frac{\partial u}{\partial x} = 4 \cdot 2 = 8$$

$$\frac{\partial f}{\partial y} = \frac{\partial f}{\partial u} \cdot \frac{\partial u}{\partial y} = 4 \cdot 1 = 4$$

$$\frac{\partial f}{\partial z} = \frac{\partial f}{\partial v} \cdot \frac{\partial v}{\partial z} = 4 \cdot 1 = 4$$

$$\frac{\partial f}{\partial t} = v = 5$$

$$\text{梯度: } \frac{\partial f}{\partial x} = 8, \quad \frac{\partial f}{\partial y} = 4, \quad \frac{\partial f}{\partial z} = 4, \quad \frac{\partial f}{\partial t} = 5$$