

Fråga 1:

- A) The weight are (1, 1) and bias is -1
- B) The weight are (1, 1) and bias is -0.5.

Fråga 2:

```
import numpy as np
import pandas as pd
def sigmoid(x):
    return 1 / (1+np.exp(-x))
sig = np.vectorize(sigmoid)
# Fråga 2
x = np.array([0.6, 0.8]) T
w1 = np.array([
    [0.2, 0.4,-0.1],
    [0.3, -0.5, 0.2]])
b1 = np.array([-0.1, 0.2, 0.3])
w2 = np.array([-0.4, 0.1, 0.6])
b2 = 0.2
z1 = sig(np.matmul(w1 T,x) + b1) T
```

Svar: 2.8231617371032716

Fråga 3:

$$\mathcal{L}(\hat{y}) = -y \log(\hat{y}) - (1-y) \log(1-\hat{y})$$

kan vara

$$\hat{y} = \frac{e^u}{1 + e^u}$$

$u = w^T x$ Kedjeregeln ger att:

$$\mathcal{L}(w) = \mathcal{L}'(\hat{y}) \cdot \hat{y}'(u) \cdot u'(w)$$

$$u = w^T x = w_1 x_1 + w_2 x_2 + \dots$$

$$\nabla u = x$$

$$\hat{y}'(u) = \frac{-e^{-u}}{(1 + e^{-u})^2} = -e^{-u} \cdot \hat{y}^2$$

$$\mathcal{L}'(\hat{y}) = \frac{-y}{\hat{y}} - \frac{(1-y)}{1-\hat{y}}$$

$$\mathcal{L}'(\hat{y}) \cdot \hat{y}'(u) =$$

$$\left(\frac{-y}{\hat{y}} - \frac{(1-y)}{1-\hat{y}} \right) \cdot e^{-u} \cdot \hat{y}^2 =$$

$$\left(\frac{y - y\hat{y} - \hat{y} + y\hat{y}}{\hat{y}(1-\hat{y})} \right) \cdot e^{-u} \cdot \hat{y}^2 =$$

$$\frac{(y - \hat{y}) \cdot e^{-u} \cdot \hat{y}}{(1-\hat{y})} = \frac{(y - \hat{y}) \cdot e^{-u} (1 - e^{-u})}{-e^{-u} (1 - e^{-u})^{-1}}$$

$$= (y - \hat{y})$$

$$\mathcal{L}'(w) = (y - \hat{y}) x$$

$$1 - \hat{y} = \frac{1}{1 + e^u}$$

$$= \frac{1 - e^{-u}}{1 + e^{-u}}$$

$$\frac{-e^{-u}}{1 + e^{-u}}$$

Fråga 4:

The output size can be given by:

$$(\text{number of pixels} - \text{kernel size}) / \text{stride} + 1 = 59$$

