INF201 Exercise 5

Fill out group member info and **NMBU-emails.**. Only **one member has to upload a .ipynb and .pdf file to Canvas.**

name_1: My partner left, will find a new one next time

name_2: Eskil Digernes

nmbu_email_1: fill out 1st member's NMBU-email here

nmbu_email_2: eskil.digernes@nmbu.no

In [ ]:
```python
import numpy as np
from copy import deepcopy

# relu activation function
def relu(x):
    return np.maximum(0, x)

# 1: single layer neural network
def single_layer(x, W1, b1):
    return relu(W1@x + b1)

# 2: two layer neural network
def two_layer(x, W1, b1, W2, b2):
    y1 = single_layer(x, W1, b1)
    y2 = single_layer(y1, W2, b2)
    return y2

# 3: L-layer neural network
def multi_layer(x, W, b, L):
    y = deepcopy(x)   # Initialize y
    for l in range(L):
        y = relu(W[l]@ y + b[l])
    return y

# 4: output and dimensionality
def print_output_and_dims(yL, W, L):
    print("Output of the Neural Network (yL):", yL)
    print("\n")
    for l in range(L):
        print(f"Dimensions of weight matrix W{l+1}: {W[l].shape}")

# Example usage
n = [64, 128, 128, 128, 10]  # Layers definition

# use random numbers in all matrices and vectors...
W = [np.random.rand(n[i+1], n[i]) for i in range(len(n)-1)]
x = np.random.rand(n[0])
b = [np.random.rand(n[i+1]) for i in range(len(n)-1)]

L = len(n) - 1  # Total number of layers

# using single-layer
y1 = single_layer(x, W[0], b[0])
# print("Output of Single Layer:", y1)
# print("\n")

# using two-layer
y2 = two_layer(x, W[0], b[0], W[1], b[1])
# print("Output of Two Layer:", y2)
# print("\n")

# using multi-layer
yL = multi_layer(x, W, b, L)
print("\n")

# Printing output and dimensions
print_output_and_dims(yL, W, L)
```

```
Output of the Neural Network (yL): [4529402.67142503 4541247.54913069 4401865.40474453 4286004.22675279
 4306193.58994691 4436416.44261691 4494910.87477807 4494843.64991678
 4448845.36924529 4124739.33325381]


Dimensions of weight matrix W1: (128, 64)
Dimensions of weight matrix W2: (128, 128)
```

```
Dimensions of weight matrix W3: (128, 128)
Dimensions of weight matrix W4: (10, 128)
```