ARTIFICIAL INTELLIGENCE

2023/2024 – 2nd semester

WORKSHEET 2 - PERCEPTRON

Perceptrons are one-layer neural networks that use the signal function as the activation function. Its learning algorithm is as follows:

```
Initialize the weights randomly
do
    for each learning example x from the learning set do
        a = output of the network when the input is x
        if a <> T(x) (the network answer is not correct)
            change all the network weights as follows:
            w_i_new = w_i_old + alfa × (T(x) – a) × x_i
            where alpha represents the learning rate
until a == T(x) for all the learning examples
```

1. Write the `Perceptron` class, which represents a Perceptron neuron. The class should have an array of weights, as well as the bias weight. It should also have the following methods:

```
def fit(self, xx: np.ndarray, yy: np.ndarray, learning_rate: float = 0.1,
seed: int = 1) -> None:
```

Given the learning data xx, the learning labels yy, the learning rate and random number generator's seed, this method implements the learning algorithm above.

```
def predict(self, x: np.ndarray) -> int:
```

Given a sample x, this method computes the output of the network.

2. Implement the main function that allows you to test the perceptron. Train a perceptron so that it is able to model the AND and OR logical functions.

3. What happens if you try to teach the XOR function to the perceptron? Why?