# Loss Functions and Activation Functions

## Advice

Note that your code will also be assessed for its **readability** and **documentation [1 mark]**. Think about how you can make your code easier for someone else to understand. Organize your code with your peers in mind, and comment your code to help them.

The following questions ask you to edit come classes. When doing so, you may introduce class member variables if it makes your code more efficient.

## Question 3: Implementing Logistic [4 marks]

Notice that the jupyter notebook `as02.ipynb` includes the class `Logistic`. Familiarize yourself with the code. The class has both a `__call__` function and a `derivative` function. Complete the functions as described below.

a) `__call__(z)`: This function computes the logistic function on each element of the input NumPy array. The output is a NumPy array the same size as the input.

b) `derivative()`: This function evaluates the derivative of the logistic function.

c) Demonstrate both of the above functions on a small dataset with a $3 \times 2$ array `z`.

## Question 4: Implementing Cross-Entropy [4 marks]

The notebook also includes the class `CrossEntropy`. Familiarize yourself with the code. The class has both a `__call__` function and a `derivative` function. Complete the functions as described below.

a) `__call__(y, t)` This function evaluates and returns the average cross-entropy between outputs `y` and targets `t`.

b) `derivative()`: This function evaluates the derivative of the average cross-entropy with respect to the outputs `y`.

c) Demonstrate both of the above functions on a $3 \times 2$ dataset with appropriately-chosen `y` and `t`.

## Question 5: Loss Gradient [1 mark]

Using a small dataset `(z, t)` (both $3 \times 2$ arrays), evaluate the derivative of the average cross-entropy with respect to each element in `z`. In other words, if $y = \sigma(z)$, then evaluate $\nabla_z E(y, t)$, where $\sigma$ is the logistic function, and $E$ is the average cross-entropy loss function.

**Submit the updated notebook to Kritik with the filename `as02.ipynb`. Make sure that nothing in the file can be used to identify you. Remember, the peer-assessment process is anonymous.**