**QUESTION #1**

Given input: X1

Weights of the first layer = W1

Weights of the second layer = W2

Ground truth be = y

Input at first layer = weights of fist layer \* Input given = W1\*X1

Therefore, the output of first layer = Input at first layer = W1\*X1 [ As linear ]

Similarly,

Input at second layer = weights of the second layer \*Output of first linear = W2\*W1\*X1

Therefore, the output of the second layer = Input at second layer = W2\*W1\*X1 [ As linear ]

Therefore, final output = W2\*W1\*X1

Therefore, loss = 1/2\*(output - ground truth)2 = 1/2\*(W2\*W1\*X1 - y)2

Cost = - loss = - 1/2\*(W2\*W1\*X1 - y)2

Calculating gradient w.r.t weights of the first and second layer :

For the second layer :

**aloss/aW2 = 1/2* (W2* W1* X1 – yº/aW2**

**Oloss/aW2 = 1/2*2* (W2*W1* X1-y) * (W2*W1* X1-y)/aW2**

**Bloss/aW2 = (W2*W1* X1 - y) *W1* X1**

For the first layer :

**aloss/aW1 = 1/2* (W2* W1* X1 – y)/aW1**

**Oloss/aW1= 1/2*2* (W2*W1* X1-y) * (W2*W1* X1-y)/aW1**

**Oloss/aW1= (W2 *W1* X1-y) *W2 * X1**

**QUESTION 2**

Na: True

Action potentials are considered an all-or the nothing event i.e. once the threshold potential is reached there is always complete depolarization of the neuron occurs. Once the depolarization process is completed, the cell must now make its membrane voltage back to the resting potential for another impulse. During an action potential generation; the sodium channel first **activates** then driving the upstroke & lastly inactivate, facilitating repolarization to the resting membrane potential. The channel's gate (activation gate) is closed at rest and activates in several steps to the Na: True state after depolarization of the neurons. This **increases** the membrane potential inside the cell and leads to more depolarization (positive feedback loop).

K: False

An open potassium channel, allowing potassium to rush out of the cell down its electrochemical gradients. These events rapidly **decrease** the membrane potential; bringing it back toward its normal resting states. The action potential cycle may then begin again and the process continues.