**Experiment 2**

**Aim:**

To study and understand Gradient Descent Algorithm

**Objective:**

1. To perform Linear Regression using Gradient Descent Algorithm

**Software platform:**

Matlab

**Theory:**

**Linear Regression:**

Linear regression is an approach for modeling relationship between a scalar dependent variable y and one or more independent variables. When there is single independent variable it is called simple linear regression and when there are more than one independent variables, it is called multiple linear regression. Linear regression is a statistical procedure for predicting the value of a dependent variable from an independent variable when the relationship between the variables can be described with linear model given by y = m \* x + c.

* **Gradient Descent**

In this method goal is to obtain parameters such that sum of squared error between target output and actual output is minimized.

Gradient descent is an iterative method. Algorithm starts with some set of values for our model parameters (weights and biases) and improves them slowly. Change in weight for each iteration is proportional to derivative of cost function w.r.t. the current weight value.

Thus algorithm moves in the direction of minima of cost function.

**Algorithm:**

Let X={x1,x2…,xm} be a vector of our input data points, Y={y1,y2…,ym} be the corresponding vector of output data points, where m is the number of samples contained in our data.

1. Initialize the values of w0, w1, α (learning rate).
2. Estimate E(w), where E(w)=1/(2M)\* ∑ ((w0+w1\*xi)-yi)2
3. Estimate new values of w0(new), w1(new) using the following equations and store it in a temporary variable.

Temp0 = w0(old)- α ∂E(w)/∂w0

Temp1 = w1(old)- α ∂E(w)/∂w1

1. Perform simultaneous update of w0(new)=Temp0

w1(new)=Temp1

1. Repeat steps 2-4 until the Error function E(w) is minimized, thus fitting a straight line through our data.

**Conclusion:**

**FAQ’S:**

1. Explain significance of learning rate in case of gradient descent algorithm?
2. What is global minima and local minima?