### **Paper Tissue Classification -**

We have data from the questionnaires survey (to ask people’s opinions) and objective testing with two attributes (acid durability and strength) to classify whether a special paper tissue is good or not. Here are four training samples -

| **X1 = Acid Durability (seconds)** | **X2 = Strength (kg/square meter)** | **Y = Classification** |
| --- | --- | --- |
| 7 | 7 | Bad |
| 7 | 4 | Bad |
| 3 | 4 | Good |
| 1 | 4 | Good |

Now the factory produces a new paper tissue that passes laboratory tests with X1 = 3 and X2 = 7. Without another expensive survey, can we guess what the classification of this new tissue is?

### **Solution -**

**Step 1 -** Determine parameter K = number of nearest neighbours. Use k=3

**Step 2 -** Calculate the distance between the query instance and all the training samples

| **X1 = Acid Durability (seconds)** | **X2 = Strength (kg/square meter)** | **Square Distance to query instance (3, 7)** |
| --- | --- | --- |
| 7 | 7 |  |
| 7 | 4 |  |
| 3 | 4 |  |
| 1 | 4 |  |

**Step 3 -** Sort the distance and determine the nearest neighbours based on the K-th minimum distance

| **X1 = Acid Durability (seconds)** | **X2 = Strength (kg/square meter)** | **Square Distance to query instance (3, 7)** | **Rank minimum distance** | **Is it included in 3 neighbours?** |
| --- | --- | --- | --- | --- |
| 7 | 7 |  |  |  |
| 7 | 4 |  |  |  |
| 3 | 4 |  |  |  |
| 1 | 4 |  |  |  |

**Step 4 -** Gather the category

| **X1 = Acid Durability (seconds)** | **X2 = Strength (kg/square meter)** | **Square Distance to query instance (3, 7)** | **Rank minimum distance** | **Is it included in 3 neighbours?** | **Y = Category of Nearest Neighbor** |
| --- | --- | --- | --- | --- | --- |
| 7 | 7 |  |  |  |  |
| 7 | 4 |  |  |  |  |
| 3 | 4 |  |  |  |  |
| 1 | 4 |  |  |  |  |

**Step 5 -** Use the simple majority of the category of nearest neighbours as the prediction value of the query instance

So the output for the classification of this new tissue with X1=3 and X2=7 is -

**Y =**