Evaluation Metrics using Confusion Matrix

1. **Logistic Regression Classification:**

Array = [85, 0]
[49, 0]

True Purchased **85**	False Not Purchased **0**
False Purchased **49**	True Not Purchased **0**

True Purchased = TP = 85
True Not Purchased = TN = 0
False Purchased = FP = 49
False Not Purchased = FN = 0
Total Purchased = TP + FN = 85
Total Not Purchased = TN + FP = 49
Sum of Purchased and Not Purchased = TP+ TN +FP +FN = 134

- **Accuracy:**

Formula: $\frac{TP + TN}{TP + FP + TN + FN}$

$= \frac{85 + 0}{85+0+49+0}$

$= \frac{85}{134}$ **= 0.63**

- **Recall:**

Formula: Purchased = TP/ Total Purchased

$= \frac{TP}{TP + FN}$

$= \frac{85}{85+0}$

$= \frac{85}{85}$ **= 1.00**

Formula: Not Purchased = TN/ Total Not Purchased

$= \frac{TN}{TN + FP}$

$= \frac{0}{0+49}$

$$= \frac{0}{49} = \mathbf{0.00}$$

- **Precision:**

  Formula: Purchased

$$= \frac{TP}{TP + FP}$$

$$= \frac{85}{85+49}$$

$$= \frac{85}{134} = \mathbf{0.63}$$

  Formula: Not Purchased

$$= \frac{TN}{TN + FN}$$

$$= \frac{0}{0+0}$$

$$= \frac{0}{0} = \mathbf{0.00}$$

- **F1 measure:**

  Formula: Purchased

$$= 2* \frac{Recall*Precision}{Recall + Precision}$$

$$= 2* \frac{1.00*0.63}{1.00+0.63}$$

$$= 2* \frac{0.63}{1.63} = \mathbf{0.78}$$

  Formula: Not Purchased

$$= 2* \frac{Recall*Precision}{Recall + Precision}$$

$$= 2* \frac{0.00*0.00}{0.00+0.00}$$

$$= 2* \frac{0.00}{0.00} = \mathbf{0.00}$$

- **Macro Average:**

  Formula: Precision

$$= \frac{\text{Precision Purchased + Precision Not Purchased}}{2}$$

$$= \frac{0.63+0.00}{2} = \mathbf{0.32}$$

Formula: Recall

$$= \frac{\text{Recall Purchased} + \text{Recall Not Purchased}}{2}$$

$$= \frac{1.00+0.00}{2} = \mathbf{0.50}$$

Formula: F1 measure

$$= \frac{\text{F1 measure Purchased} + \text{F1 measure Not Purchased}}{2}$$

$$= \frac{0.78+0.00}{2} = \mathbf{0.39}$$

- **Weighted Average:**

Formula: Precision

$$= \text{Precision Purchased} * \frac{\text{Total Purchased}}{\text{Sum of Purchased \& Not Purchased}} + \text{Precision Not Purchased} * \frac{\text{Total Not Purchased}}{\text{Sum of Purchased \& Not Purchased}}$$

$$= 0.63 * \frac{85}{134} + 0.00 * \frac{49}{134}$$

$$= 0.63 * 0.63 + 0.00 * 0.37 = \mathbf{0.40}$$

Formula: Recall

$$= \text{Recall Purchased} * \frac{\text{Total Purchased}}{\text{Sum of Purchased \& Not Purchased}} + \text{Recall Not Purchased} * \frac{\text{Total Not Purchased}}{\text{Sum of Purchased \& Not Purchased}}$$

$$= 1.00 * \frac{85}{134} + 0.00 * \frac{49}{134}$$

$$= 1.00 * 0.63 + 0.00 * 0.37 = \mathbf{0.63}$$

Formula: F1 measure

$$= \text{F1 measure Purchased} * \frac{\text{Total Purchased}}{\text{Sum of Purchased \& Not Purchased}}$$

$$+ \text{F1 measure Not Purchased} * \frac{\text{Total Not Purchased}}{\text{Sum of Purchased \& Not Purchased}}$$

$$= 0.78 * \frac{85}{134} + 0.00 * \frac{49}{134}$$

$$= 0.78 * 0.63 + 0.00 * 0.37 \quad \mathbf{= 0.49}$$