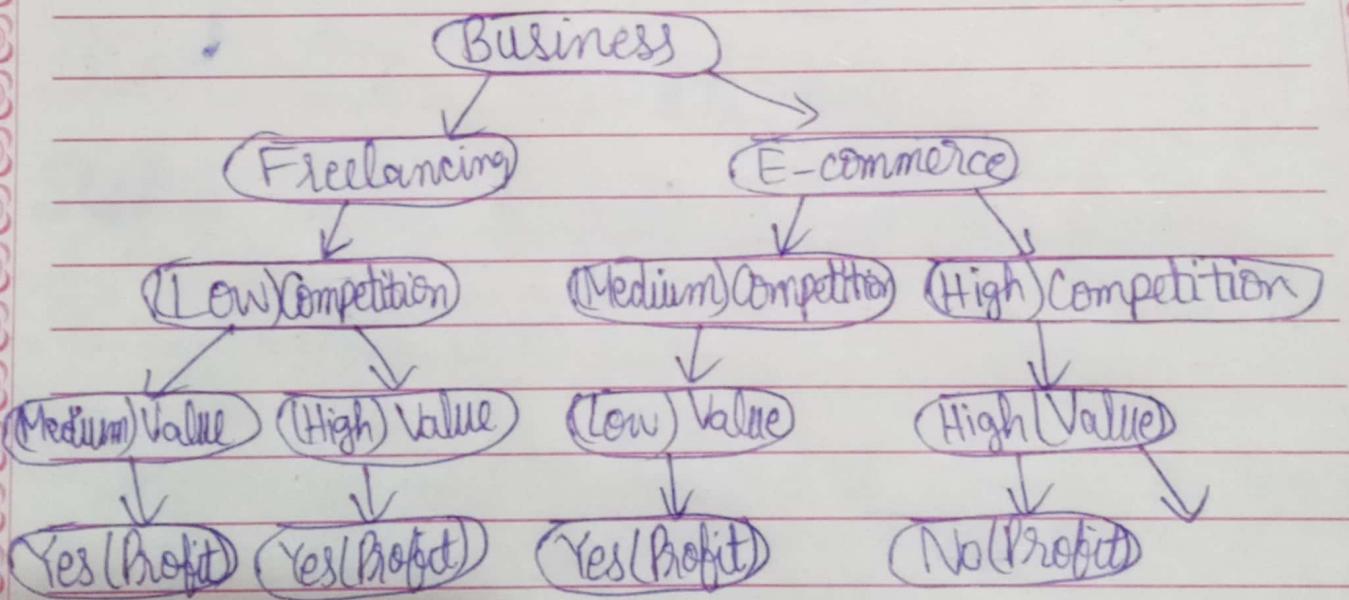


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1) Make decision tree for following dataset

Business	Competition	Value	Profit
Freelancing	Low	Medium	Yes
E-commerce	Medium	Low	Yes
E-commerce	High	High	No
Freelancing	Low	High	Yes
E-commerce	High	High	Yes
Freelancing	Low	Medium	No



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2) Apply Min-Max Scaling for range [0,1] on the following dataset

[450, 652, 236, 968, 465, 963, 789, 741, 321, 852, 951, 456]

Sorted [236, 321, 450, 456, 465, 652, 741, 789, 852, 951, 963, 968]

Formula:

$$x' = \frac{x - \min(x)}{\max(x) - \min(x)} \quad (0-1)$$

Step I:

$$\min(x) = 236 \quad , \max(x) = 968$$

Step II: Apply formula to each data point

$$x' = \frac{236 - 236}{968 - 236} \quad (0-1) = 0$$

$$x' = \frac{321 - 236}{968 - 236} \quad (0-1) = \frac{85}{732} = 0.116$$

$$x' = \frac{450 - 236}{968 - 236} \quad (0-1) = \frac{107}{732} = 0.29$$

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$$x' = \frac{456 - 236}{968 - 236} (1-0) = \frac{55}{183} = 0.3$$

$$x' = \frac{465 - 236}{968 - 236} (1-0) = \frac{229}{732} = 0.313$$

$$x' = \frac{652 - 236}{968 - 236} (1-0) = \frac{104}{183} = 0.57$$

$$x' = \frac{741 - 236}{968 - 236} (1-0) = \frac{505}{732} = 0.6898$$

$$x' = \frac{789 - 236}{968 - 236} (1-0) = \frac{553}{732} = 0.755$$

$$x' = \frac{852 - 236}{968 - 236} (1-0) = \frac{154}{183} = 0.84$$

$$x' = \frac{951 - 236}{968 - 236} (1-0) = \frac{715}{732} = 0.976$$

$$x' = \frac{963 - 236}{968 - 236} (1-0) = \frac{727}{732} = 0.993$$

$$x' = \frac{968 - 236}{968 - 236} (1-0) = 1$$

Scaled data = [0, 0.2, 0.31, 0.3, 0.32, 0.57, 0.69, 0.75, 0.84, 0.98, 0.99, 1]

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3) Apply the Z-score scaling on the following dataset.

[963, 321, 135, 852, 258, 456, 741, 951, 753, 665, 482, 520]

Formula:  $Z = \frac{x - \mu}{\sigma}$

$$\mu = \frac{135 + 258 + 321 + 452 + 456 + 520 + 665 + 741 + 753 + 852 + 951 + 963}{12}$$

$$\mu = \frac{7067}{12} = \boxed{588.92 = \mu}$$

Standard deviation:

$$S.D = \sigma = \sqrt{\frac{\sum (x - \mu)^2}{N}}$$

$$\begin{aligned} & |135 - 588.92| + |258 - 588.92| + |321 - 588.92| + \\ & |452 - 588.92| + |456 - 588.92| + |520 - 588.92| + \\ & |665 - 588.92| + |741 - 588.92| + |753 - 588.92| + \\ & |852 - 588.92| + |951 - 588.92| + |963 - 588.92| \end{aligned}$$

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$$\sigma = \boxed{262.948}$$

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$$Z = \frac{X - \mu}{\sigma} = \frac{135 - 588.92}{262.948} = -1.72$$

$$Z = \frac{X - \mu}{\sigma} = \frac{258 - 588.92}{262.948} = -1.26$$

$$Z = \frac{321 - 588.92}{262.948} = -1.02$$

$$Z = \frac{452 - 588.92}{262.948} = -0.52$$

$$Z = \frac{456 - 588.92}{262.948} = -0.505$$

$$Z = \frac{520 - 588.92}{262.948} = -0.262$$

$$Z = \frac{665 - 588.92}{262.948} = 0.289$$

$$Z = \frac{741 - 588.92}{262.948} = 0.58$$

$$Z = \frac{753 - 588.92}{262.948} = 0.62$$

$$Z = \frac{852 - 588.92}{262.948} = 1$$

$$Z = \frac{951 - 588.92}{262.948} = 1.38$$

$$Z = \frac{963 - 588.92}{262.948} = 1.43$$