Entropy of dataset :-

$$H(s) = -p(positive) \cdot \log_2(p(positive)) - p(negative) \cdot \log_2(p(negative))$$

$$= -\frac{5}{10} \cdot \log_2\left(\frac{5}{10}\right) - \frac{5}{10} \log_2\left(\frac{5}{10}\right)$$

$$= \log_2\left(\frac{10}{5}\right) = 1.$$

$$\boxed{H(s) = 1}$$

1st iteration :

For each attribute, calculating information gain :-

(i) Smell

$$H(smell = woody) = -\frac{3}{5} \log_2\left(\frac{3}{5}\right) - \frac{2}{5} \log_2\left(\frac{2}{5}\right)$$

$$= 0.971$$

$$H(smell = fruity) = 0.971$$

Avg. entropy information for smell :-

$$I(smell) = p(woody) \cdot H(smell = woody) + p(fruity) \cdot H(smell = fruity)$$

$$= \left(\frac{1}{2} \times 0.971\right) \times 2$$

$$= 0.971.$$

Info gain (smell) = $H(S) - I(\text{smell})$

$= 1 - 0.971$

(ii) Taste

$H(\text{taste} = \text{sweet}) = -1 \log_2(1) = 0$

$H(\text{taste} = \text{salty}) = \left[\frac{-1}{2} \log_2\left(\frac{1}{2}\right)\right] \times 2 = 1$

$H(\text{taste} = \text{sour}) = -1 \log_2(1) = 0$

$I(\text{taste}) = \left(\frac{3}{10} \times 0\right) + \left(\frac{4}{10} \times 1\right) + \left(\frac{3}{10} \times 0\right)$

$= 0.4$

Info gain (taste) $= 1 - 0.4 = \boxed{0.6}$

(iii) Portion

$H(\text{Portion} = \text{small}) = \frac{-1}{5} \log\left(\frac{1}{5}\right) - \frac{4}{5} \log\left(\frac{4}{5}\right)$
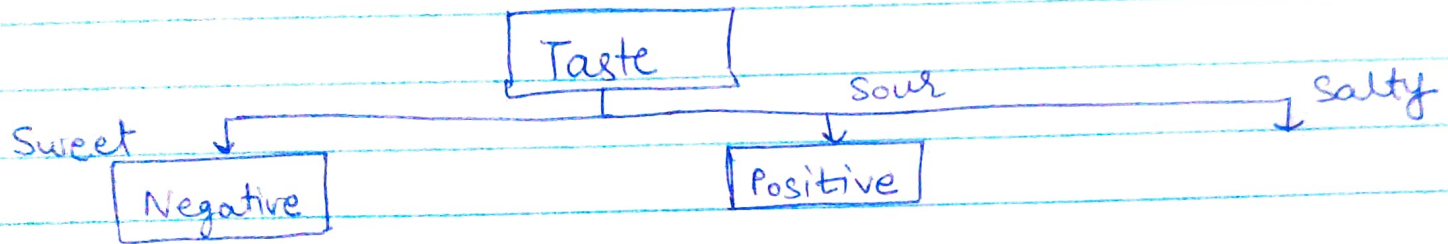
$H(\text{---"---} = \text{large}) = \frac{-4}{5} \log\left(\frac{4}{5}\right) - \frac{1}{5} \log\left(\frac{1}{5}\right)$

$I(\text{portion}) = \left[\frac{1}{2} \times \dfrac{\log 5 + 4 \log(5/4)}{5}\right] \times 2$

Info gain (portion) $= 1 - I(\text{portion}) = \boxed{0.278}$

Info gain in taste is maximum so, we will split it into taste.

2nd iteration

- $H(\text{taste} = \text{sour}) = -1 \log(1) = 0$

∴ when taste = sour, then review is positive (terminate).

- $H(\text{taste} = \text{sweet}) = -\frac{3}{3} \log\left(\frac{3}{3}\right) = 0$

∴ review is always negative, entropy = 0 (terminate).

- $H(\text{taste} = \text{salty}) = -\left[\frac{1}{2} \log\left(\frac{1}{2}\right)\right] \times 2 = 1$

(i) Smell

$H(\text{salty}, \text{smell} = \text{woody}) = 0$

$H(\underline{\quad\text{''}\quad} \text{fruity}) = -\frac{1}{2} \log(\frac{1}{2}) = 1$

$I(\text{salty}, \text{smell}) = \underline{\qquad\qquad\qquad} 1$
Info gain $= 1 - 1 = \boxed{0}$

(ii) Portion

$H(\text{salty}, \text{portion} = \text{small}) = [\frac{1}{0} \log(\frac{1}{0})] = 0$

$H(\underline{\quad\text{''}\quad} \text{large}) = -1 \log(1) = 0$

$I(\text{salty}, \text{portion}) = 0$

Info gain $(\text{salty}, \text{portion}) = \boxed{1.}$

∴ We split through portion (man info gain).

(b)