Ans. to the Q. No-01

for the variable 'Taste' the initial entropy is given below -

Here, total 5 sample is 'Meh'

and total 5 sample is 'Yummy'

and the total sample is 10.

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

$$= 1$$

Ans to the Q. No-2

From the dataset, we can see that the 'Visual deffect' variable has 10 samples. Total there are 3 types of samples as "Some", "None", "Many".

$S_{Some} = [0+, 3-]$

$S_{None} = [2+, 2-]$

$S_{Many} = [3+, 0-]$

We know from the equation of Information Gain $IG(Y) = H(Y) - H(Y|X)$

$H(Taste \mid Visual\ defect == 'Some')$

$= -\frac{3}{3}\log_2\left(\frac{3}{3}\right) - \frac{0}{3}\log_2\left(\frac{0}{3}\right)$

$= 0$

$H(Taste \mid Visual\ defect == 'None')$

$= -\frac{2}{4}\log_e\left(\frac{2}{4}\right) - \frac{2}{4}\log_2\left(\frac{2}{4}\right)$

$= 1$

$H(\text{Taste} \mid \text{Visual defect} == \text{'Many'})$

$$= -\frac{0}{3}\log_2\left(\frac{0}{3}\right) - \frac{0}{3}\log_2\left(\frac{0}{3}\right)$$

$$= 0$$

$$IG(\text{Visual Defect}) = 1 - \left[\frac{4}{10} \times 1 + \frac{3}{10} \times 0 + \frac{3}{10} \times 0\right]$$

$$= 1 - 0.4$$

$$= 0.6 \quad \text{(Ans.)}$$

Ans. to the Q. No - 3

From the answer of Ques. 2 we can see that For the samples of 'Some', among 3 total items 3 is "Yummy" and 0 is "Meh". And for the samples of 'None' → 2 are "Yummy" and other 2 are "Meh".

$$H(\text{Taste} \mid \text{Visual defect} == \text{'Some'})$$

$$= -\frac{3}{3}\log_2\left(\frac{3}{3}\right) - \frac{0}{3}\log_2\left(\frac{0}{3}\right) = 0$$

$$H(\text{Taste} \mid \text{Visual defect} == \text{'None'})$$

$$= -\frac{2}{4}\log_2\left(\frac{2}{4}\right) - \frac{2}{4}\log_2\left(\frac{2}{4}\right) = 1$$

(Ans.)