# Q1

| Creature type | Color | Limbs | Size | Odorous |
|---|---|---|---|---|
| M | No | 3 | Small | yes |
| M | yes | 2 | tall | No |
| M | yes | 3 | tall | No |
| M | No | 2 | Small | yes |
| M | Yes | 3 | tall | No |
| H | No | 2 | tall | yes |
| H | No | 2 | Small | No |
| H | No | 2 | tall | No |
| H | yes | 2 | small | No |
| H | No | 2 | tall | yes |

$E(S) = -\dfrac{5}{10}\log_2 \dfrac{5}{10} - \dfrac{5}{10}\log_2 \dfrac{5}{10} = 0.5 + 0.5 = 1.$

$E(color\overset{=No}{}) = -\dfrac{2}{6}\log_2 \dfrac{2}{6} - \dfrac{4}{6}\log_2 \dfrac{4}{6} = 0.918$

$E(color = yes) = -\dfrac{3}{4}\log_2 \dfrac{3}{4} - \dfrac{1}{4}\log_2 \dfrac{1}{4} = 0.811$

$9.G(color) = 1 - \left\{ \dfrac{6}{10}(0.918) + \dfrac{4}{10}(0.811)\right\} = 0.1248$

$E(limbs = 3) = -\dfrac{3}{3}\log_2 \dfrac{3}{3} - \dfrac{0}{3}\log_2 \dfrac{0}{3} = 0$

$E(limbs = 2) = -\dfrac{2}{7}\log_2 \dfrac{2}{7} - \dfrac{5}{7}\log_2 \dfrac{5}{7} = 0.86.$

$9.G(limbs) = 1 - \left\{ \dfrac{3}{10}\log(0) + \dfrac{7}{10}(0.86)\right\} = 0.398 \ (maximum).$

$E(Size = small) = -\dfrac{2}{4}\log_2 \dfrac{2}{4} - \dfrac{2}{4}\log_2 \dfrac{2}{4} = 1.$

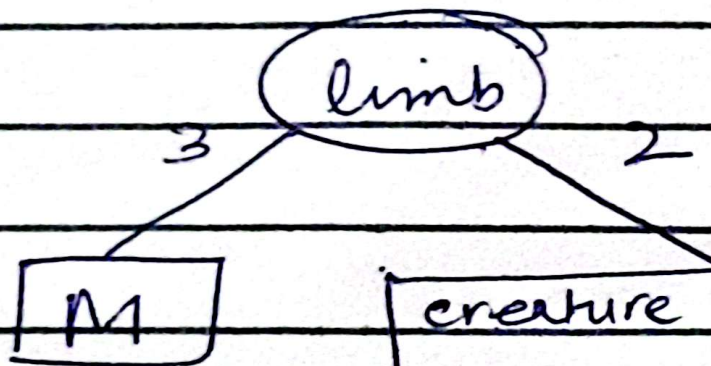$E(Size = tall) = -\dfrac{3}{6}\log_2 \dfrac{3}{6} - \dfrac{3}{6}\log_2 \dfrac{3}{6} = 1$

$9.G(Size) = 1 - \left\{ \dfrac{4}{10}(1) + \dfrac{6}{10}(1)\right\} = 0$

$E(odor = yes) = -\dfrac{2}{4}\log \dfrac{2}{4} - \dfrac{2}{4}\log_2 \dfrac{2}{4} = 1.$

$E(odr = No) = -\dfrac{3}{6}\log_2 \dfrac{3}{6} - \dfrac{3}{6}\log_2 \dfrac{3}{6} = 1$

$9.G(odorous) = 1 - \left\{ \dfrac{4}{10}(1) + \dfrac{6}{10}(1)\right\} = 0$

limb

3 — M

2 —

| creature | color | size | odor |
|----------|-------|-------|------|
| M | yes | tall | No |
| M | No | small | yes |
| H | No | tall | yes |
| H | No | small | No |
| H | No | tall | No |
| H | yes | small | No |
| H | No | tall | yes |

$E(color = yes) = -1/2 \log_2 1/2 - 1/2 \log_2 1/2 = 1$.

$E(color = no) = -1/5 \log_2 1/5 - 4/5 \log_2 4/5 = 0.722$.

$IG(color) = 0.863 - \left\{ \frac{2}{7}(1) + \frac{5}{7}(0.722) \right\} = 0.062 \ (max)$

$E(Size = tall) = -1/4 \log_2 1/4 - 3/4 \log_2 3/4 = 0.811$

$E(Size = small) = -1/3 \log_2 1/3 - 2/3 \log_2 2/3 = 0.918$

$IG(size) = 0.863 - \left\{ \frac{4}{7}(0.811) + \frac{3}{7}(0.918) \right\} = 0.0061$

$E(odor = No) = -1/4 \log_2 1/4 - 3/4 \log_2 3/4 = 0.811$.

$E(odor = yes) = -1/3 \log_2 1/3 - 2/3 \log_2 2/3 = 0.918$

$IG(odor) = 0.863 - \left\{ \frac{4}{7}(0.811) + \frac{3}{7}(0.918) \right\} = 0.0061$

$E(S3) = -1/5 \log_2 1/5 - 4/5 \log_2 4/5 = 0.722$
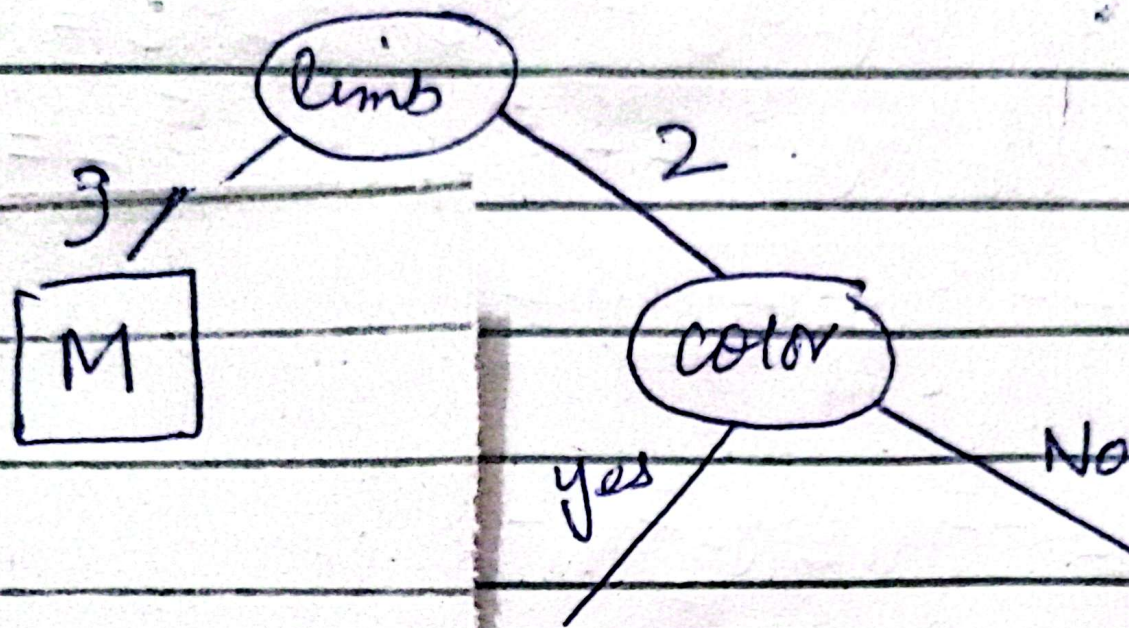
$E(Size = small) = -1/2 \log_2 1/2 - 1/2 \log_2 1/2 = 1$.

$E(Size = tall) = -0/3 \log_2 0/3 - 3/3 \log_2 3/3 = 0$.

$IG(Size) = 0.722 - \left\{ 2/5(1) - 3/5(0) \right\} = \boxed{0.322} \ max$.

$E(odor = yes) = -1/3 \log_2 1/3 - 2/3 \log_2 2/3 = 0.918$

$E(odor = No) = -0/2 \log_2 0/2 - 2/2 \log_2 2/2 = 0$.

$IG(odor) = 0.722 - \left\{ 3/5(0.918) + 2/5(0) \right\} = 0.1712$.

limb

3 / 2

M

color

yes / No

S3

| creat | size | odor |
|-------|-------|------|
| M | tall | No |
| H | small | NO |

| creat | size | odor |
|-------|-------|------|
| M | small | yes |
| H | tall | yes |
| H | small | No |
| H | tall | No |
| H | tall | yes |