Assignment - 9

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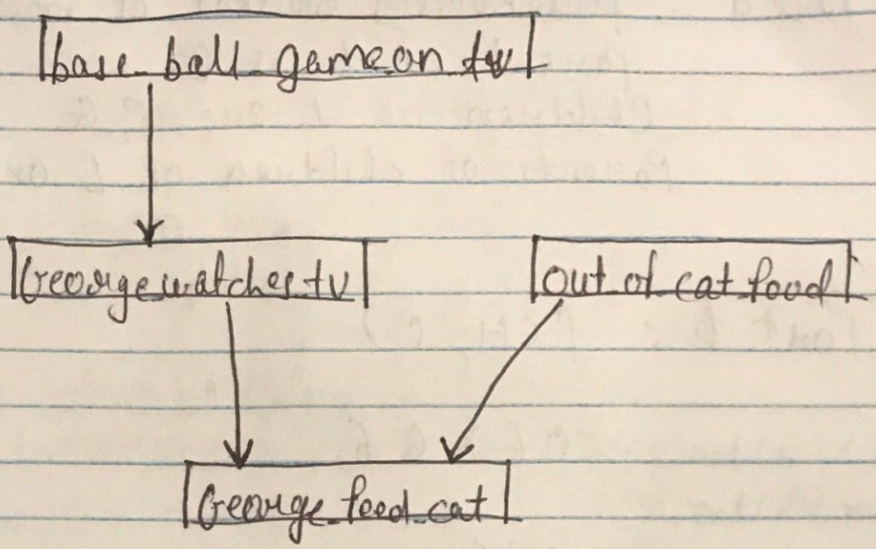
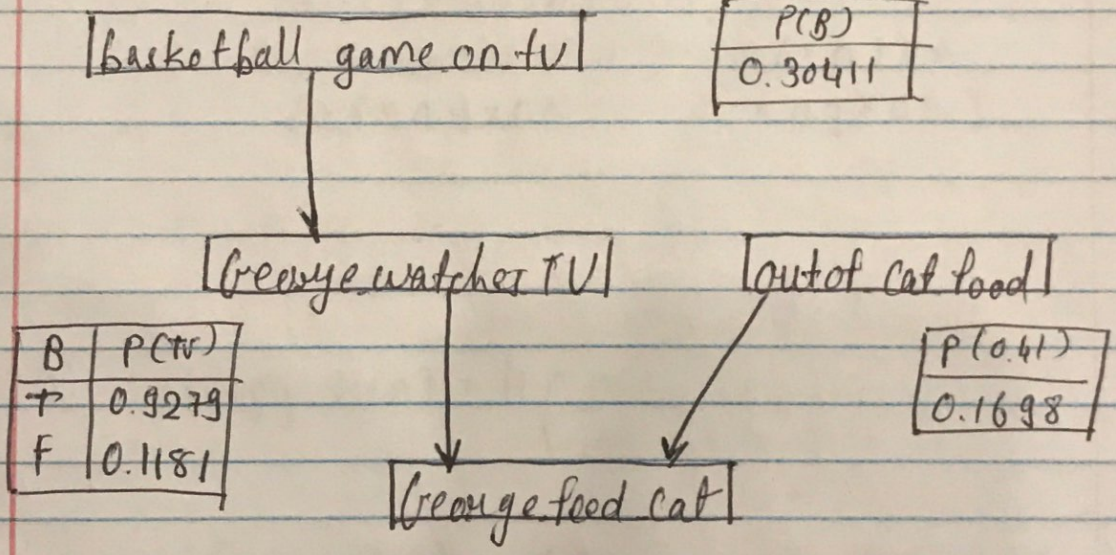
Task-1



Task-2



TV	out	P(C=T)	P(C=F)
T	T	0.0416	0.9583
T	F	0.7064	0.2935
F	T	0.3157	0.6842
F	F	0.9587	0.04124

TV: George watches TV

Out: Out of CAT food

Task 3

Part a : Markoving Blanket of node L

Parent of L is O.

Children of L are P, Q

Parents of children of L are K, M

Part b : P(H, C)

= 0.6 X 0.6

= 0.36

Part C

$$P(M, not(C) / H)$$

$$= \frac{P(M, not(C), H)}{P(H)}$$

$$= \frac{P(M) * P(not(C)) * P(H)}{P(H,M,C) + P(H,M,\overline{C}) + P(H, not(M), C) + P(H, not(M), not(C))}$$

$$= \frac{(0.1)(0.4)(0.1)}{(0.1 \times 0.1 \times 0.4) + (0.6 \times 0.6 \times 0.1) + (0.6 \times 0.9 \times 0.6) + (0.1 \times 0.9 \times 0.4)}$$

$$= 0.01$$

Task-5 ⓐ Entropy $H(A) = H\left(\frac{80}{100}, \frac{20}{100}\right)$

$$H(A) = -\frac{80}{100} \log_2\left(\frac{80}{100}\right) - \frac{20}{100} \log_2\left(\frac{20}{100}\right)$$

$$H(A) = 0.2575 + 0.4643$$

$$= 0.7218$$

(b) Info Gain

$$= H(A) - \frac{35}{100} \times H\left(\frac{30}{85}, \frac{15}{35}\right) - \frac{65}{100} \times H\left(\frac{5}{65}, \frac{60}{65}\right)$$

$$= 0.7218 - \frac{35}{100}\left(-\frac{20}{35}\log_2\left(\frac{20}{35}\right) - \frac{15}{35}\log_2\left(\frac{15}{35}\right)\right) - \frac{65}{100}\left(-\frac{60}{65}\log\left(\frac{60}{65}\right) - \frac{5}{65}\log\left(\frac{5}{65}\right)\right)$$

$$= 0.7218 - 0.344 - 0.2543$$

Info Gain = 0.1229

(c) Info Going would be 0

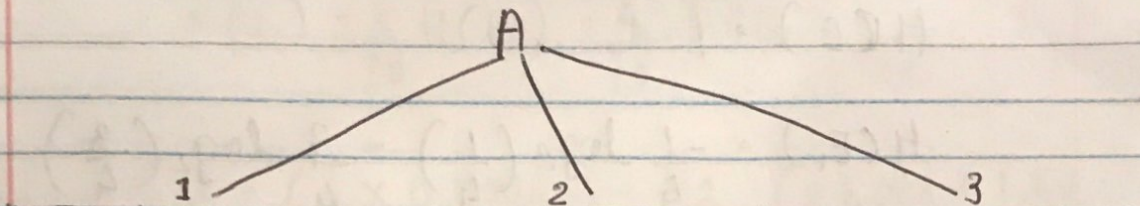
It's seperated. Therefore
No, change would be observed.

(d) A → B → D

Leaf node → D

Output : will wait

Task 6 Consider 1st case with A as root node



Class	A=1	B	C
X		2	1
X		3	3
X		2	2

② Total = 3
X = 3
Y = 0

Class	A=2	B	C
X		1	2
Y		1	1
Y		1	2
Y		1	1

③ X = 1
Y = 3
Total = 4

Class	A=3	B	C
X		2	2
Y		1	1
Y		3	1

④ Total = 3
X = 1
Y = 2

① $H(E) = 1$

② $H(E_1) = 0$

③ $H(E_2) = \frac{1}{4}\log_2\left(\frac{1}{4}\right) - \frac{3}{4}\log_2\left(\frac{3}{4}\right)$

$= 0.81127$

④ $H(E_3) = -\frac{1}{3}\log_2\left(\frac{1}{3}\right) - \frac{2}{3}\log_2\left(\frac{2}{3}\right)$

$= 0.5278 - 0.3956$

$= 0.9234$

Info Gain (A)

$= H(E) - \frac{4}{10}H(E_2) - \frac{3}{10}H(E_3)$

$= 0.3858$

* 2nd Case with B as root node

$H(E) = 1$

$H(E_1) = -\frac{1}{4}\log_2\left(\frac{1}{4}\right) - \frac{3}{4}\log_2\left(\frac{3}{4}\right)$

$= 0.81127$

$H(E_2) = -\frac{3}{4}\log_2\left(\frac{3}{4}\right) - \frac{1}{4}\log_2\left(\frac{1}{4}\right)$

$= 0.821127$

$H(E_3) = 1$

$\text{Info Gain}(B) = 1 - \frac{4}{10}H(E_1) - \frac{4}{10}H(E_2) - \frac{2}{10}H(E_3)$

$= 0.1512$

* Considering 3rd case with C as root node

$H(E) = 1$

$H(E_1) = -\frac{1}{5}\log_2\left(\frac{1}{5}\right) - \frac{4}{5}\log_2\left(\frac{4}{5}\right)$

$= 0.7218$

$H(E_2) = -\frac{3}{4}\log_2\left(\frac{3}{4}\right) - \frac{1}{4}\log_2\left(\frac{1}{4}\right)$

$= 0.81127$

$H(E_3) = 0$

Info Gain (C)

$= H(C) - \frac{5}{10} H(E_1) - \frac{4}{10} H(E_2) - \frac{1}{10} H(E_3)$

$= 1 - \left(\frac{1}{2} \times 0.7218\right) - \left(\frac{2}{5} \cdot (2 \times 0.8 + 1.29\right)$

$= 0.3146$

Info Gain (A) > Info Gain (C) > Info Gain (B)

$0.3458 > 0.3146 > 0.1512$

∴ A receiver highest Info Gain