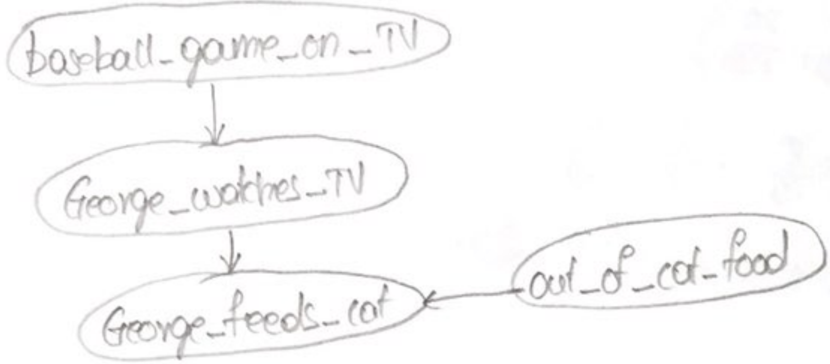
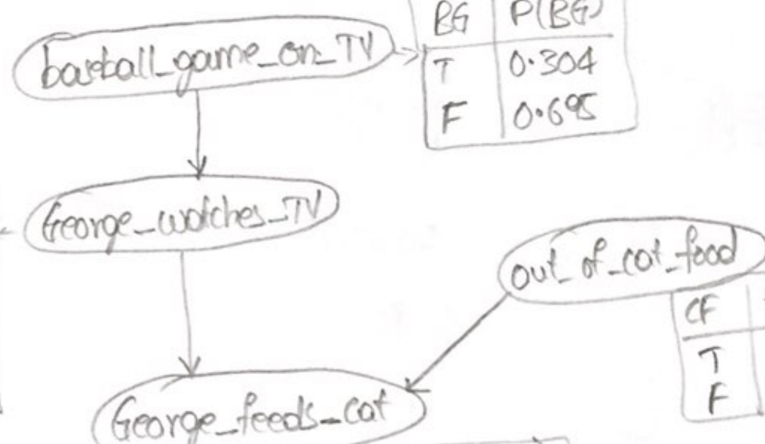
Assignment (9)

(1)



(2)



BG	P(BG)
T	0.304
F	0.695

	P(GW|BG)	P(GW|BG)
BG	GW=T	GW=F
T	0.927	0.072
F	0.118	0.881

CF	P(CF)
T	0.169
F	0.830

		P(GC|GW,CF)	P(GC|GW,CF)
CF	GW	GC=T	GC=F
T	T	0.0416	0.9583
T	F	0.3157	0.6842
F	T	0.7064	0.2935
F	F	0.958	0.0412

BG = Baseball_game_on_TV
GW = George_watches_TV
CF = Out_of_cat_food
GC = George_feeds_cat.

3 (a) Markovian blanket of node L: G, K, M, P, Q.

(b) $P(H,C) = P(H \mid Parent(H)) \times P(C \mid Parent(C))$

$= P(H \mid C) \times P(C)$

$= 0.6 \times 0.6$

$= 0.36$

(c) $P(M, \text{not}(c) \mid H) = \dfrac{P(M \mid H) \times P(H \mid \neg C) \times P(\neg C)}{[P(H \mid \neg C) \times P(\neg C)] + [P(H \mid C) \times P(C)]}$

$= \dfrac{0.1 \times 0.1 \times 0.4}{(0.1 \times 0.4) + (0.6 \times 0.6)} = \dfrac{0.004}{0.4} = 0.01$

(5)

(a) Node A:

$X = 100$
$X_1 = 80$
$X_2 = 20$

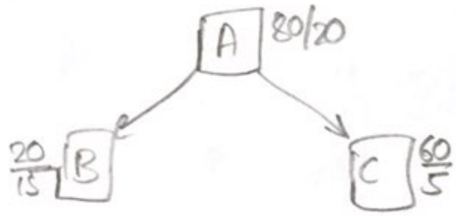
$$H_A = H\left(\frac{80}{100}, \frac{20}{100}\right)$$

$$= -\frac{8}{10}\ln\frac{8}{10} - \frac{2}{10}\ln\frac{2}{10}$$

$$= -0.8(-0.321) - 0.2(-2.321)$$

$$= \underline{0.721}$$

(b)



$$H_B = H\left(\frac{20}{35}, \frac{15}{35}\right) = (-0.571)(-0.874) - 0.428(-1.22)$$

$$= \underline{0.985}$$

$$H_C = H\left(\frac{60}{65}, \frac{5}{65}\right) = (-0.923)(-0.115) - (0.076)(-3.700)$$

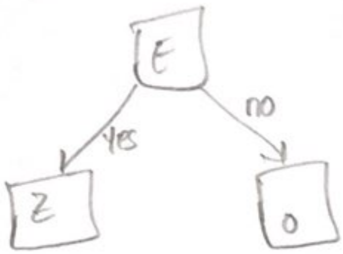
$$= \underline{0.390}$$

$$\underline{I} = (0.721 - 0.35)(0.985 - 0.65)(0.39)$$

$$= 0.721 - 0.344 - 0.254$$

$$= \underline{0.122}$$

(c)

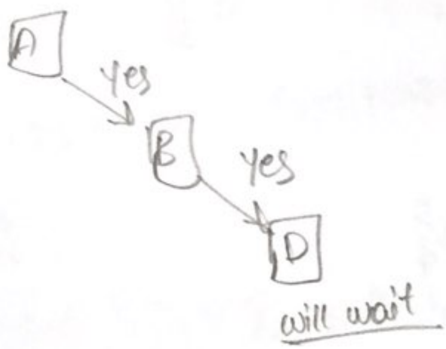


let node E has Z samples
All have weekend = y.

$$I = H\left(\frac{x_1}{Z}, \frac{x_2}{Z}\right) - \frac{Z}{Z} H\left(\frac{x_1}{Z}, \frac{x_2}{Z}\right) - 0$$

$$= 0$$

(d) Hungry, Rainy, weekend.



(6) Entropy at the beginning

$$H\left(\frac{5}{10}, \frac{5}{10}\right) = -\frac{1}{2}\ln\frac{1}{2} - \frac{1}{2}\ln\frac{1}{2} = \underline{1}$$

<u>A attribute</u>:

$A = 1 \Rightarrow x, x, x$
$A = 2 \Rightarrow x, y, y, y$
$A = 3 \Rightarrow x, y, y$

$H_{A=1} = 0$

$$H_{A=2} = H\left(\frac{1}{4}, \frac{3}{4}\right) = -\frac{1}{4}\ln\frac{1}{4} - \frac{3}{4}\ln\frac{3}{4}$$

$$= \underline{0.8113}$$

$$H_{A=3} = H\left(\frac{1}{3}, \frac{2}{3}\right) = -\frac{1}{3}\ln\frac{1}{3} - \frac{2}{3}\ln\frac{2}{3}$$

$$= \underline{0.917}$$

$$I_A = H - H_{A=1} - \frac{4}{10}H_{A=2} - \frac{3}{10}H_{A=3}$$

$$= 1 - 0 - (.4 \times .8113) - (.3 \times 0.917)$$

$$= 0.4$$

<u>B attribute:</u>

$B = 1 \Rightarrow x, y, y, y$

$B = 2 \Rightarrow x, x, x, y$

$B = 3 \Rightarrow x, y$

$$H_{B=1} = H\left(\frac{1}{4}, \frac{3}{4}\right) = -\frac{1}{4}\ln\frac{1}{4} - \frac{3}{4}\ln\frac{3}{4}$$

$$= \underline{0.8113}$$

$$H_{B=2} = H\left(\frac{3}{4}, \frac{1}{4}\right) = -\frac{3}{4}\ln\frac{3}{4} - \frac{1}{4}\ln\frac{1}{4}$$

$$= \underline{0.811}$$

$$H_{B=3} = H\left(\frac{1}{2}, \frac{1}{2}\right) = \underline{1}$$

$$I_B = H - \frac{4}{10}H_{B=1} - \frac{4}{10}H_{B=2} - \frac{2}{10}H_{B=3}$$

$$= 1 - (0.4 \times 8113) - (0.4 \times 0.811) - (0.2 \times 1)$$

$$= \underline{0.151}$$

c attribute:

$c=1 \Rightarrow x, y, y, y, y$

$c=2 \Rightarrow x, x, x, y$

$c=3 \Rightarrow x$

$H_{c=1} = H\left(\frac{1}{5}, \frac{4}{5}\right) = -\frac{1}{5}\ln\frac{1}{5} - \frac{4}{5}\ln\frac{4}{5} = \underline{0.721}$

$H_{c=2} = H\left(\frac{3}{4}, \frac{1}{4}\right) = -\frac{3}{4}\ln\frac{3}{4} - \frac{1}{4}\ln\frac{1}{4} = \underline{0.8113}$

$H_{c=3} = 0$

$I_c = H - \frac{5}{10} H_{c=1} - \frac{4}{10} H_{c=3} - H_{c=3}$

$= 1 - (0.5 \times 0.721) - (0.4 \times 0.8113) - 0$

$= \underline{0.314}$

choose attribute A $\because I_A$ is the highest.