Quiz 4

TASK 1

(a) $P(\text{Color} \neq \text{Green} \mid \text{Vehicle} = \text{Truck})$

$$= \frac{P(\text{Color} \neq \text{Green} \wedge \text{Vehicle} = \text{Truck})}{P(\text{Vehicle} = \text{Truck})}$$

$$= \frac{0.1554 + 0.0966}{0.1584 + 0.1680 + 0.0966} = 0.6$$

(b) $P(\text{Color} \neq \text{Green}) = 1 - P(\text{Color} = \text{Green})$

$$= 1 - [0.1280 + 0.0480 + 0.1680 + 0.0560]$$

$$= 0.6 = P(\text{Color} \neq \text{Green} \mid \text{Vehicle} = \text{Truck})$$

So Color & Vehicle are independant from each other.

Task 2

(a)

A 11 dimentional table 7 across one dimension & 8 across the other dimension.

7×8^{10} values in Total.

7,516,192,768 values in theory

(or)

7,516,192,767 in practice

(b)

Using Conditional independce we need to store

$P(A)$ & 10 $P(B_i/A)$ distributions

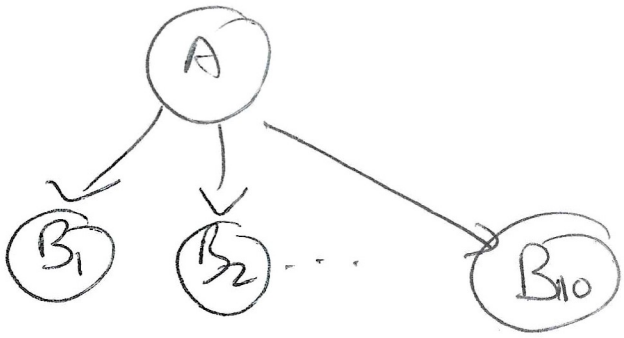
So in theory we would need to store.

$7 + (8 \times 7) \times 10 = 567$

In Practice we need to store.

$$6 * (7 \times 7) \times 10 = 496$$

(c) Yes. If A is the Cause & each B_i is its effect then it does follow Naive-Bayes Model



Task 3b

Lets represent

B : Baseball_game_on_tv

G : George_watches_TV

C : Out_of_cat_food.

F : gerge_feeds_cat

$$P(\text{not}(\text{Baseball\_game\_on\_TV}) / \text{not}(\text{George\_feeds\_Cat}))$$

$$= P(\neg B / \neg F)$$

$$= \frac{P(\neg B \wedge \neg f)}{P(\neg F)}$$

$$P(\neg F) = P(B \wedge A \wedge C \wedge \neg F)$$
$$+ P(B \wedge A \wedge \neg C \wedge \neg F)$$
$$+ P(B \wedge \neg A \wedge C \wedge \neg F)$$
$$+ P(B \wedge \neg A \wedge \neg C \wedge \neg F)$$
$$+ P(\neg B \wedge A \wedge C \wedge \neg F)$$
$$+ P(\neg B \wedge A \wedge \neg C \wedge \neg F)$$
$$+ P(\neg B \wedge \neg A \wedge C \wedge \neg F)$$
$$+ P(\neg B \wedge \neg C \wedge \neg C \wedge \neg F)$$

$$= P(B) \times P(A/B) \times P(C) \times P(\neg F/A,C)$$
$$+ P(B) \times P(A/B) \times P(\neg C) \times P(\neg F/A,\neg C)$$
$$+ P(B) \times P(\neg A/B) \times P(C) \times P(\neg F/\neg A,C)$$
$$+ P(B) \times P(\neg A/B) \times P(\neg C) \times P(\neg F/\neg A,\neg C)$$
$$+ P(\neg B) \times P(A/\neg B) \times P(C) \times P(\neg F/A,C)$$
$$+ P(\neg B) \times P(A/\neg B) \times P(\neg C) \times P(\neg F/A,\neg C)$$
$$+ P(\neg B) \times P(\neg A/\neg B) \times P(C) \times P(\neg F/\neg A,C)$$
$$+ P(\neg B) \times P(\neg A/\neg B) \times P(\neg C) \times P(\neg F/\neg A,\neg C)$$

$$= 0.304109589 \times 0.927927928 \times 0.169863014 \times 0.958333333$$
$$+ 0.304109589 \times 0.927927928 \times 0.830136986 \times 0.293577982$$
$$+ 0.304109589 \times 0.072072072 \times 0.169863014 \times 0.684210526$$
$$+ 0.304109589 \times 0.072072072 \times 0.830136986 \times 0.041237113$$

$$= 0.695890411 \times 0.118110236 \times 0.169863014 \times 0.958333333$$
$$+ 0.695890411 \times 0.118110236 \times 0.830136986 \times 0.293577982$$
$$+ 0.695890411 \times 0.881889764 \times 0.169863014 \times 0.684210526$$
$$+ 0.695890411 \times 0.881889764 \times 0.830136986 \times \cancel{0.293577982} \times 0.041237113$$

$$= 0.243751575$$

$$P(\neg B \wedge \neg F) = P(\neg B \wedge A \wedge C \wedge \neg F) + P(\neg B \wedge A \wedge \neg C \wedge \neg F) + P(\neg B \wedge \neg A \wedge C \wedge \neg F) + P(\neg B \wedge \neg A \wedge \neg C \wedge \neg F)$$

$$= P(\neg B) \times P(a/\neg B) \times P(c) \times P(\neg f/a,c)$$
$$+ P(\neg B) \times P(a/\neg B) \times P(\neg c) \times P(\neg f/a,\neg c)$$
$$+ P(\neg B) \times P(\neg a/\neg B) \times P(c) \times P(\neg f/\neg a,c)$$
$$+ P(\neg B) \times P(\neg a/\neg B) \times P(\neg c) \times P(\neg f/\neg a,\neg c)$$

$$= 0.125744303$$

$$P(\neg B/\neg f) = \frac{0.125744303}{0.243751575}$$

$$= 0.515870730$$

Task 4

(a)

Markov blanket of L

Parents: G

Children: P, Q

Children's other parents: K, M

So G, P, Q, K, M.

(b)

$$P(A, F) = P(F/A)\ P(A)$$

$$= 0.8 \times 0.8$$

$$= 0.64$$

(c)

$$P(M, \neg C / H)$$

$$= \frac{P(M, \neg C, H)}{P(H)}$$

$$= \frac{P(M/H) \cdot P(H/\neg C)\, P(\neg C)}{P(H \wedge C) + P(H \wedge \neg C)}$$

$$= \frac{P(M/H)\, P(H/\neg C)\, P(\neg C)}{P(H/C)\, P(C) + P(H/\neg C)\, P(\neg C)}$$

$$= \frac{0.1 \times 0.1 \times 0.4}{0.6 \times 0.6 + 0.1 \times 0.4} = \frac{0.004}{0.4}$$

$$= 0.01$$