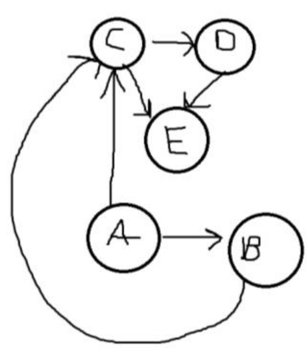
1. P(Gun)=0.02
P(Coin)=0.3
P(Nothing)=0.68
P(Beep | Gun)=0.95
P(Beep | Coin)=0.8
P(Beep | Nothing)=0.25

Items(Gun, Coin, Nothing)

$\mathrm{P(Beep)} = \sum_{x\epsilon(Items)} \mathrm{P(X)} * \mathrm{P(Beep|X)}$
= P(Gun) * P(Beep | Gun) + P(Coin)* P(Beep | Coin) + P(Nothing)* P(Beep | Nothing)
=0.02*0.95 + 0.3*0.8+0.68*0.25
=0.429

P(Gun | Beep) = P(Beep | Gun)* P(Gun) / P(Beep)
= 0.95*0.02 / 0.429
=0.044289

2.
   a. P(B | A) P(C | A) P(D |A) P(E | A, D) P(F | D) P(G|B, C ,E, F)
   b.



   c. 10^5-1 Rows will be needed
   d. We would need 221 rows as P(A) needs one row, P(D | C) and P(B|A) need 10 rows each so 20 rows, P(C| A, B) and P(E|C,D) need 100 rows each so 200 rows. 200+20+1 is 221, hence 221 rows.

3.
   a. Query P(B|G , E)
   Order G, E, A , B, C, D, F
   Initial factors: F1(A),F2(B,A), F3(C,A,B), F4(D,A,C), F5(E,A,D), F6(F,A,E), F7(G,B,C)
   Eliminating G via conditioning: F8 (B,C)= F7(G,B,C) given that G= True(Assuming True/False Values)

Eliminating E via conditioning: F9(A,D)= F5(E,A,D)
F10(F,A)=F6(F,A,E), given E=True
Eliminating A via summation: F11(B,C,D,F)=∑ F9(F,A,D) F10(F,A)F1(A) F2(B,A)F3(C,A,B)F4(D,A,C) for all A values
Eliminating C via summation: F12(B,D,F)=∑ F11(B,C,D,F) for all C values
Eliminating D via summation: F13(B,F)=∑ F12(B,D,F)for all D values
Eliminating F via summation: F14(B)=∑ F13(B,F) for all F values
Normalize F14(B)→ F14(B)/(∑ F14(B) for all values of B) to give us the query(B)

b. Query P(B|G , E)
Order G, E, F,D,C,B, A
Initial factors: F1(A),F2(B,A), F3(C,A,B), F4(D,A,C), F5(E,A,D), F6(F,A,E), F7(G,B,C)
Eliminating G via conditioning: F8 (B,C)= F7(G,B,C) given that G= True(Assuming True/False Values)
Eliminating E via conditioning: F9(A,D)= F5(E,A,D)

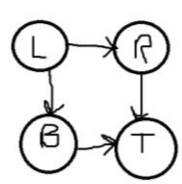
F10(F,A)= F6(F,A,E), given E=True

Eliminating F via summation: F11(A)=∑ F10(F,A) for all F values
Eliminating D via summation: F12(A,C)=∑ F9(A,D) F4(D,A,C) for all D values
Eliminating C via summation: F13(A,B)=∑ F12(A,C) F8(B,C) F3(C,A,B)for all C values
Eliminating A via summation: F14(B)=∑ F12(A,B) F1(A) F11(A)F2(A,B)for all A values
Normalize F14(B)→ F14(B)/(∑ F14(B) for all values of B) to give us the query(B)

c. The 2nd order of variables is the faster one as we have less computations done with our second order of eliminations(26) rather than the first one (52)

4.

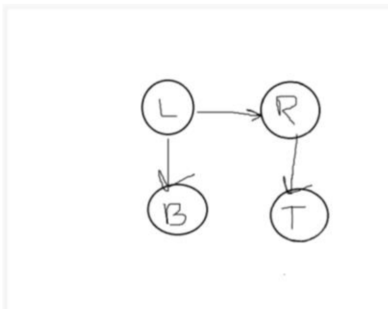
a.



b. Factorization: P(L), P(B | L) P(R | L) P(T |B,R)
c. P(T=High|B=Many)=

$$\frac{\sum_{L,R} P(T|B,R)P(B|L)P(L)P(R|L)}{\sum_{T,R,L} P(T|B,R)P(B|L)P(L)P(R|L)}$$

d.



e. P Hat(T=High| do(B=Many)=

$$\frac{\sum_{L,R} P(T|R)P(B|L)P(L)P(R|L)}{\sum_{T,R,L} P(T|R)P(B|L)P(L)P(R|L)}$$