PGM - Assignment 3 Solutions

Question 1

a. True

b. True

c. True

d. False

e. False

f. False

g. False

h. False

i. True

j. True

k. True

Question 2

a. What is the probability of fever, if no disease is present?

- Since no diseases are present, only the leak is to be taken
- $P(Fever = False) = 1 - \lambda_0$
- $\therefore P(Fever = True) = \lambda_0$

b. What is the probability of fever, if all disease is present?

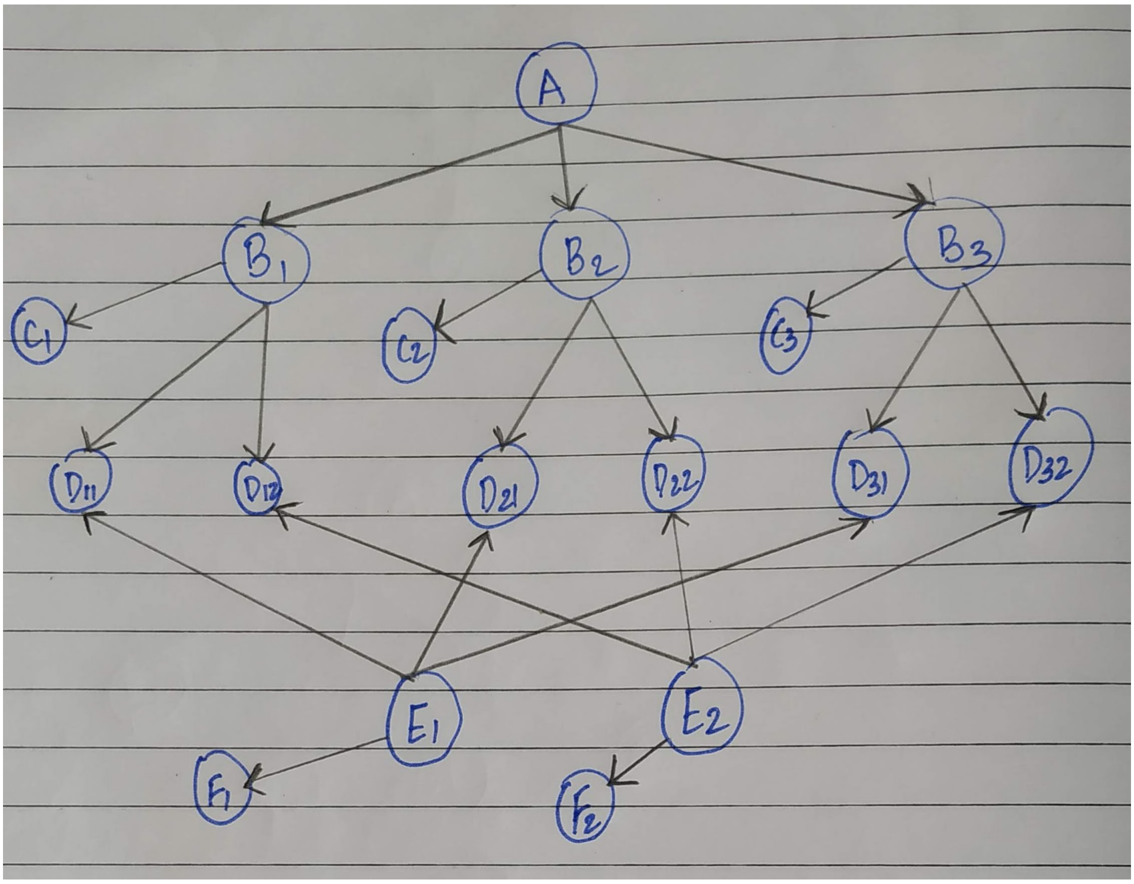
- When all diseases are given,
- $P(Fever = False) = (1 - \lambda_0)(1 - \lambda_1)(1 - \lambda_2)\ldots(1 - \lambda_n)$
- $P(Fever = False) = (1 - \lambda_0)\prod_{i=1}^{n}(1 - \lambda_i)$
- $P(Fever = True) = 1 - [(1 - \lambda_0)\prod_{i=1}^{n}(1 - \lambda_i)]$

c. What is the probability of fever, if the diseases with an odd count (D1, D3, D5, ...) are present and even count (D2, D4, D6, ...) are not present. Assume n is even.

- Combining previous cases,
- $P(Fever = False) = (1 - \lambda_0)(1 - \lambda_1)(1 - \lambda_3)(1 - \lambda_5)\ldots(1 - \lambda_{n-1})$
- $P(Fever = False) = (1 - \lambda_0)[\prod_{i=0}^{\frac{n-2}{2}}(1 - \lambda_{2n+1})]$
- $P(Fever = True) = 1 - [(1 - \lambda_0)\prod_{i=0}^{\frac{n-2}{2}}(1 - \lambda_{2n+1})]$

Question 3

Unrolled version of the Bayesian Network :



Probability Distributions needed :

$$P(A)$$
$$P(B|A)$$
$$P(C|B)$$
$$P(D|B,E)$$
$$P(E)$$
$$P(F|E)$$