

$$1.a) P(B=Y) = (0.1+0.1+0.15) = 0.35$$

$$b) P(B=X|A=M) = 0.05$$

$$C) P(A=H) = (0.15+0.15+0.05) = 0.35$$

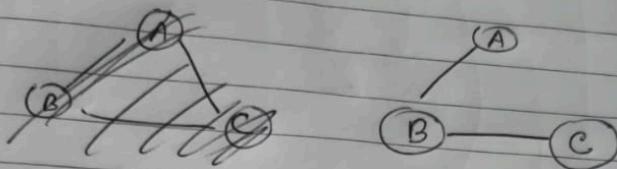
2.

$$\int_0^T e^{-\ln t} = 0.25 \quad | \quad 0.013$$

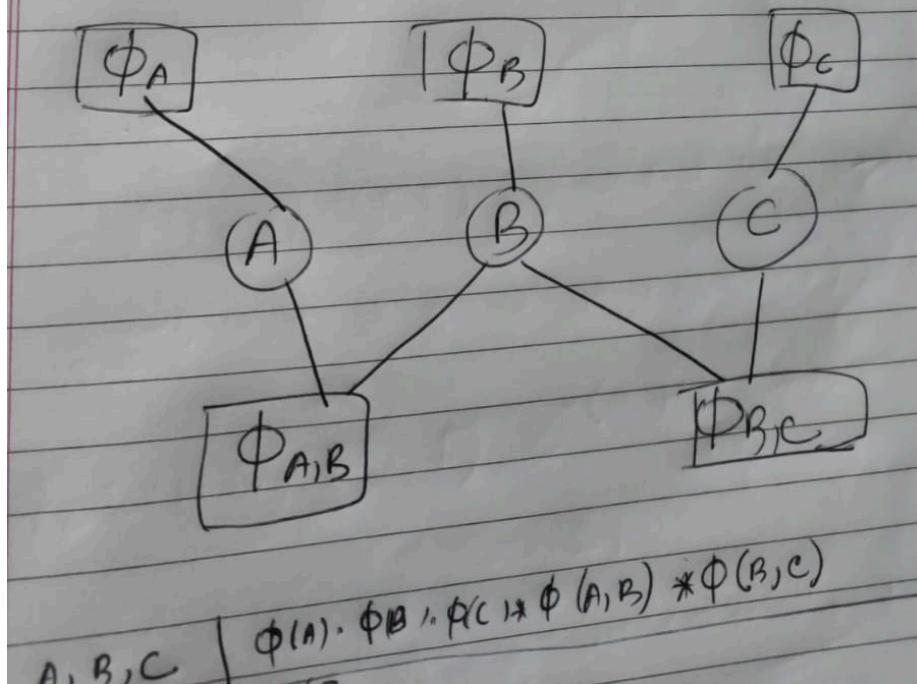
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Saat

a. Markov Network graph



b. Factor graph



3.

$$\phi_1(x_1, x_2) = (T, T) = e^{-(w_1 f_1 + w_2 f_2 + w_3 f_3 + w_4 f_4)} \\ = e^{-(0 + 0 + 0 + 1 \cdot (-\ln 8))} = 8$$

$$\phi_2(x_1, x_2) = (T, F) = e^{-(0 + 1 \cdot (-\ln 7) + 1 \cdot (-\ln 3) + 0)} \\ = 21$$

$$\phi_3(x_1, x_2) = (F, T) = e^{-(1 \cdot -\ln 5 + 0 + 1 \cdot -\ln 3 + 0)} \\ = 15$$

$$\phi_4(x_1, x_2) = (F, F) = e^{-(1 \cdot -\ln 5 + 1 \cdot -\ln 7 + 0 + 1 \cdot -\ln 8)} \\ = 280$$

$$Z = 324$$

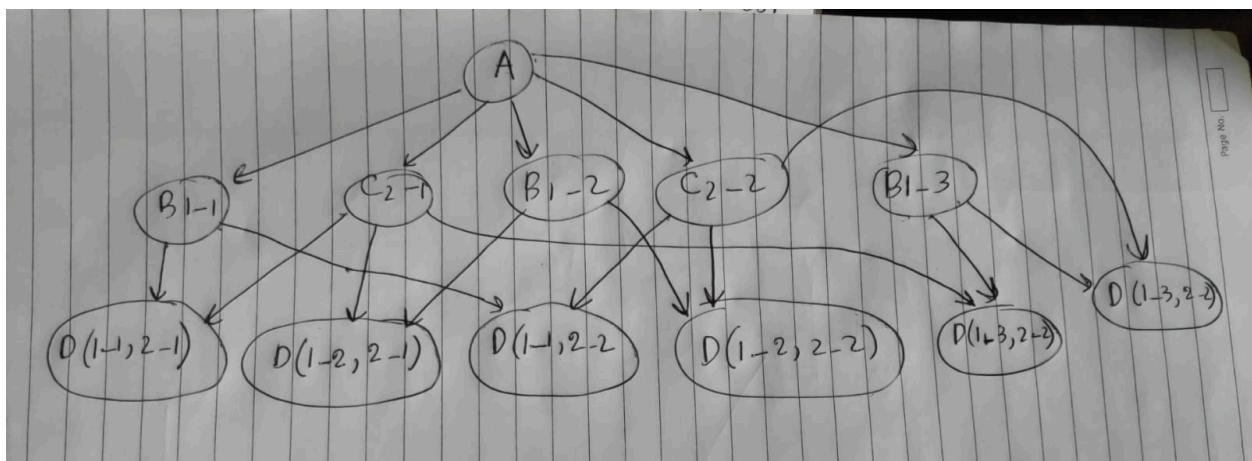
$$P(X_1=F, X_2=T) \Rightarrow \frac{\phi_3}{Z} = \frac{15}{324} = 0.046$$

Page No. 

4.a

$$\text{aa. } P(A) \prod_{i=1}^n P(B_i | A) \prod_{j=1}^m P(C_j | A) \cdot P(D_{ij} | B_i C_j)$$

b.



Date \_\_\_ / \_\_\_ / \_\_\_

6. 1. MLE :

$$P(X=T) = \frac{15+10}{15+10+5+10} = \frac{25}{40} = \frac{5}{8} = 0.62$$

$$P(X=F) = 1 - P(X=T) = 0.38$$

$$P(Y|X) = P(Y=R | X=T) = 15/25$$

$$P(Y=B | X=T) = 10/25$$

$$P(Y=R | X=F) = 10/15$$

$$P(Y=B | X=F) = 5/15$$

2.  $\kappa_2$  for  $P(Y|X)$

$$P(Y=R | X=T) = 15+1/25+2 = 16/27$$

$$P(Y=B | X=T) = 10+1/25+2 = 11/27$$

$$P(Y=R | X=F) = 10+1/15+2 = 11/17$$

$$P(Y=B | X=F) = 5+1/15+2 = 6/17$$

5.

Variable	All Factors	Participates	New Factor After *	New Factor After +
C	$P(A), P(B A), P(D), P(C B,D), P(E C)$	$P(C B,D), P(E C)$	$f1(C,B,D,E)$	$t1(B,D,E)$
D	$t1(B,D,E), P(A), P(B A), P(D)$	$t1(B,D,E), P(D)$	$f2(D,B,E)$	$t2(B,E)$
A	$t2(B,E), P(A), P(B A)$	$P(A), P(B A)$	$f3(A,B)$	$t3(B)$
B	$t3(B), t2(B,E)$	$t3(B), t2(B,E)$	$f4(B,E)$	$t4(E)$
Normalize		$t4(E)$		