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سوال (۱):

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Procasination : Pn Overthinking: Or

Perfectionism: Pe Negativity: Ne

1. ~~Or ⊥ Pr | Pe, Ne~~ → Guaranteed

2. Pe ⊥ Ne | Or → Guaranteed

(→

$$P(Ne, Pr, Or, Pe = True) = P(Pe) \times P$$

$$= P(Pe^{=True}) \times P(Or/Pe^{=True}) \times P(Ne/Or) \times P(Pr/Pe^{=True}, Ne)$$

$$P(Pe = True) \times \sum_{Or} P(Or/Pe = True) \sum_{Ne} P(Ne/Or) \times P(Pr/Pe = True, Ne)$$

$$P(Pe = True) \times \sum_{Or} P(Ne/Or) \times P(Or/Pe = True) \sum_{Pr} P(Pr/Pe = True, Ne)$$

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سوال (2):

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$$P(+c \mid +a, +b, +d) = \frac{P(+c, +b, +d, +a)}{P(+a, +b, +d)}$$

$$P(+a, +b, +c, +d) = P(+d \mid +c, +a) \times P(+c \mid +b) \times P(+b \mid +a) \times P(+a)$$

$$= 0,6 \times 0,1 \times 0,8 \times 0,5 = 0,024$$

$$P(+a, +b, +d) = \sum_{C} P(+a, +b, +d, C) = 0,024 + P(+a, +b, +c, +d) + P(+a, +b, -c, +d)$$

$$= 0,024 + P(+d \mid +c, +a) \times P(-c \mid +b) \times P(+b \mid +a) \times P(+a) =$$

$$= 0,024 + 0,1 \times 0,9 \times 0,8 \times 0,5 = 0,024 \times 0,036 = 0,06$$

$$\Rightarrow P(+c \mid +a, +b, +d) = \frac{0,024}{0,06} = 0,4$$

— Rejection Sampling در این روش با توجه به اینکه می‌خواهیم $B = +b$ باشد هر Sample که $B = -b$ باشد رد می‌شود.

در این جا دو Sample $\{+a, -b\}$ و $\{-a, -b\}$ رد می‌شوند.

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$-a \quad +b \quad -c \quad +d \rightarrow w_1 = P(+b|-a) \times P(+d|-c,-a) = 0,4 \times 0,5 = 0,2$

$+a \quad +b \quad -c \quad +d \rightarrow w_2 = P(+b|+a) \times P(+d|-c,+a) = 0,8 \times 0,1 = 0,08$

$+a \quad +b \quad -c \quad +d \rightarrow w_3 = P(+b|+a) \times P(+d|+a,-c) = 0,8 \times 0,1 = 0,08$

$+a \quad +b \quad +c \quad +d \rightarrow w_4 = P(+b|-a) \times P(+d|-a,+c) = 0,4 \times 0,2 = 0,08$

$+a \quad +b \quad +c \quad +d \rightarrow w_5 = P(+b|+a) \times P(+d|+a,+c) = 0,8 \times 0,6 = 0,48$

$$P(+a|+b,+d) = \frac{P(+a,+b,+d)}{\sum_{a,c} P(A,+b,C,+d)} = \frac{w_2 + w_3 + w_5}{\sum_{i=1} w_i} \Rightarrow$$

$$\Rightarrow P(+a|+b,+d) = \frac{0,08 + 0,08 + 0,48}{0,2 + 3 \times 0,08 + 0,48} = \frac{0,64}{0,92} = 0,696$$

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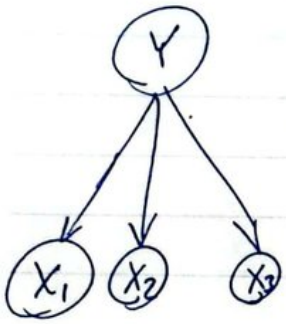
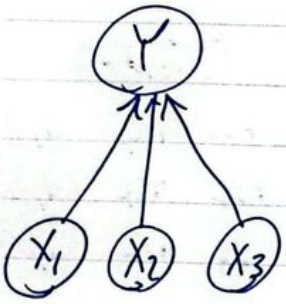
سوال 3) دامنه هر متغیر را x می‌گیریم



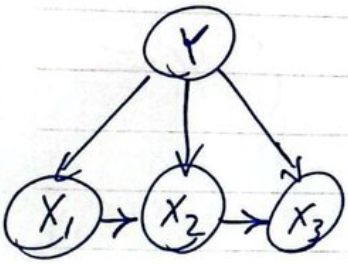
$$\rightarrow P(Y, X_1, X_2, X_3) = P(Y)\,P(X_1|Y)\,P(X_2|Y)\,P(X_3|Y)$$

↳ Space: $x + 3x^2$



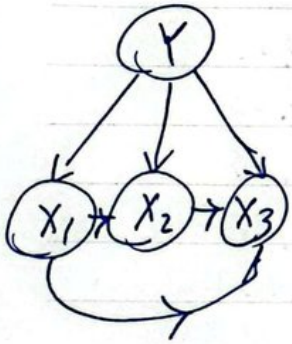
$$\rightarrow P(Y, X_1, X_2, X_3) = P(X_1)\,P(X_2)\,P(X_3)\,P(Y|X_1, X_2, X_3)$$

↳ Space: $3x + x^4$



$$\rightarrow P(Y, X_1, X_2, X_3) = P(Y)\,P(X_3|Y, X_2)\,P(X_2|Y, X_1) \times P(X_1|Y)$$

↳ Space: $x + x^2 + 2x^3$



$$P(Y, X_1, X_2, X_3) = P(Y)\,P(X_3|Y, X_1, X_2)\,P(X_2|Y, X_1) \times P(X_1|Y)$$

↓

Space: $x + x^2 + x^3 + x^4$

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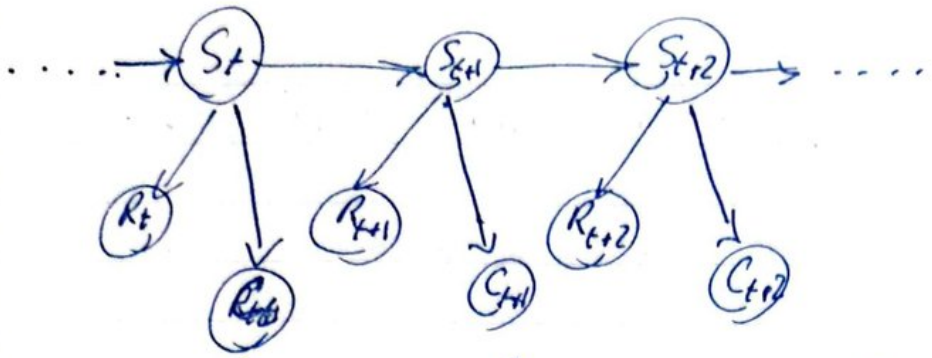
سوال ۴

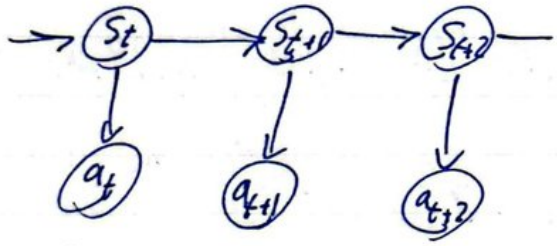


$P(S_t)$	
$+S_t$	0,6
$-S_t$	0,4

$P(S_t \mid S_{t-1})$		
$+S_{t-1}$	$+S_t$	0,9
$+S_{t-1}$	$-S_t$	0,1
$-S_{t-1}$	$+S_t$	0,2
$-S_{t-1}$	$-S_t$	0,8

$P(R_t \mid S_t)$		
$+S_t$	$+r_t$	0,1
$+S_t$	$-r_t$	0,9
$-S_t$	$+r_t$	0,7
$-S_t$	$-r_t$	0,3

$P(C_t \mid S_t)$		
$+S_t$	$+C_t$	0,2
$+S_t$	$-C_t$	0,8
$-S_t$	$+C_t$	0,4
$-S_t$	$-C_t$	0,6



$O_t : (S_t, C_t)$

$P(S_t)$	
$+S_t$	0,6
$-S_t$	0,4

$P(S_t \mid S_{t-1})$		
$+S_{t-1}$	$+S_t$	0,9
$+S_{t-1}$	$-S_t$	0,1
$-S_{t-1}$	$+S_t$	0,2
$-S_{t-1}$	$-S_t$	0,8

$P(a_t \mid S_t)$		
$+S_t, +C_t$	$+S_t$	0,02
$+S_t, +C_t$	$-S_t$	0,28
$+S_t, -C_t$	$+S_t$	0,08
$+r_t, -C_t$	$-S_t$	0,42
$-r_t, +C_t$	$+S_t$	0,18
$-r_t, +C_t$	$-S_t$	0,12
$-r_t, -C_t$	$+S_t$	0,72
$-r_t, -C_t$	$-S_t$	0,18

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سوال (5):

~~$P(A,B,C,$~~ (1

$w_i = P(A=ON, B=OFF, C=ON, D=OFF) =$

$= P(A=ON \mid X_t=n) \times P(B=OFF \mid X_t=n) \times P(C=ON \mid X_t=n) \times P(D=OFF \mid X_t=n)$

$X_t = 13 \rightarrow w = 0,6 \times 0,4 \times 0,6 \times 1 \times 0,6 = 0,1414$

$X_t = 12 \rightarrow w = 0,4 \times 0,6 \times 0,4 \times 0 = 0$

$X_t = 2 \rightarrow w = 1 \times 0,6 \times 0,4 \times 0,6 = 0,144$

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$X_t = 13 \rightarrow w = 0,4 \times 0,6 \times 1 \times 0,6 = 0,144$

$X_t = 12 \rightarrow w = 0,4 \times 0,6 \times 1 \times 0 = 0$

$X_t = 2 \rightarrow w = 1 \times 0,6 \times 1 \times 0,6 = 0,36$

(3

$$P(X_6 = 11) = \frac{0,16}{0,144 + 0,1 + 0,16} = \frac{0,16}{0,5} = 0,32$$

$$Exp(X_t = 11) = n\,P(X_6 = 11) = 32$$