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ASSIGNMENT - 8.

Q.1.] a) Probability of Sensor at Maine
$\rightarrow 0.05$

$\therefore$ probability of Sensor at sahara
$\rightarrow 0.95$.

Temprature	Sensor at Maine	Sensor at Sahara.
≥ 80	0.20	0.90
< 80	0.80	0.10

Now, $P(M | \leq 80) = ?$

By Bayes Theorem,

$$P(M|<80) = \frac{P(M) \cdot P(<80|M)}{P(<80)}.$$

$\because P(M) = 0.05, \quad P(S) = 0.95.$

$$P(M|<80) = \frac{0.05 \times 0.80}{P(<80)}.$$

$$P(<80) = P(<80|M) \cdot P(M) + P(<80|S) \cdot P(S)$$

$$= 0.80 \times 0.05 + 0.10 \times 0.95$$

$$= 0.04 + 0.095$$

$$\boxed{P(<80) = 0.135}$$

$$\therefore P(M|<80) = \frac{0.05 \times 0.80}{0.135} = 0.296.$$

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b) x_{m1} = mail 1
x_{m2} = mail 2.
x : Temprature daily high < 80

$P(x/m) = 0.80$, $P(x/S) = 0.90$.
$P(x_{m1}) = P(x_{m1}/m) \cdot P(m) +$
$P(x_{m2}/S) \cdot P(S)$

$P(x_{m2} \wedge x_{m1}) = P(x_{m2} \wedge x_{m1}/m) \cdot P(m)$
$+ P(x_{m2} \wedge x_{m1}/S) \cdot P(S)$

$= P(x_{m2}/m) \cdot P(x_{m1}/m) \cdot P(m) +$
$P(x_{m2}/S) \cdot P(x_{m1}/S) \cdot P(S)$

$= 0.80 \times 0.80 \times 0.05 + 0.10 \times 0.10$
$\times 0.95$
$= 0.032 + 0.095$.
$= \underline{\underline{0.127}}$ //

c) x_{m1} = mail 1
x_{m2} = mail 2
x_{m3} = mail 3
$\therefore P(x_{m1} \wedge x_{m2} \wedge x_{m3}) = P(x_{m1} \wedge x_{m2} \wedge x_{m3}/m)$
$P(m) + P(x_{m1} \wedge x_{m2} \wedge x_{m3}) \cdot P(S)$
$= 0.80 \times 0.80 \times 0.80 \times 0.05 +$
$0.10 \times 0.10 \times 0.10 \times 0.95$
$= 0.0256 + 0.00095$
$= \underline{\underline{0.02655}}$ //

Q.2.] a). Variable A has 5 values.
$B_1 \ldots B_{10}$ have 7 possible values
each B_i is independent of all
other 9 B_j variables
Given A ÷ 5×7^{10} numbers.//

b) Reduced & space efficient way
would be
$= (2 \times 10 \times 5) + (5-1) \ldots P(A)$
requires 5-1 : 4 values.
$= 100 + 4$
$= 104$ values.//

Q.3.] a) P(A|B).
$\rightarrow P(A|B=T) = \alpha[\langle P(A=T, B=T, C=T),$
$P(A=F, B=T, C=T)\rangle +$
$\langle P(A=T, B=F, C=F), P(A=F, B=T, C=F)\rangle]$
$= \alpha[\langle 0.048, 0.012\rangle + \langle 0.196, 0.294\rangle]$
$= \alpha\langle 0.244, 0.306\rangle$
$= \langle 0.444, 0.556\rangle$
$\rightarrow P(A|B=F) = \alpha[\langle P(A=T, B=F, C=T),$
$P(A=F, B=F, C=T)\rangle + \langle P(A=T, B=F, C=F),$
$P(A=F, B=F, C=F)\rangle]$
$= \alpha\langle 0.276, 0.174\rangle$
$= \langle 0.613, 0.387\rangle$

$P(A|B) = \langle 0.444, 0.556\rangle \quad \langle 0.613, 0.387\rangle$

b) $P(A|B=T, C=T) = \alpha \langle P(A=T, B=T, C=T),$
$P(A=F, B=T, C=T) \rangle$
$= \alpha \langle 0.048, 0.12 \rangle$
$= \langle 0.8, 0.2 \rangle$ $\alpha = 0.06$

$P(A|B=F, C=F) = \alpha \langle P(A=T, B=F, C=F),$
$P(A=F, B=F, C=F) \rangle$
$= \alpha \langle 0.084, 0.126 \rangle$
$= \langle 0.4, 0.6 \rangle$ $\alpha = 0.21$

$P(A|B=T, C=F) = \alpha \langle P(A=T, B=T, C=F),$
$P(A=F, B=T, C=F)$
$= \alpha \langle 0.084, 0.126 \rangle$
$= \cancel{\alpha} \langle 0.4, 0.6 \rangle$ $\alpha = 0.21$

$P(A|B=F, C=T) = \alpha \langle P(A=T, B=F, C=T)$
$P(A=F, B=F, C=F)$
$= \alpha \langle 0.192, 0.048 \rangle$
$= \langle 0.8, 0.2 \rangle$

$P(A|B, C) = \langle 0.8, 0.2 \rangle \langle 0.4, 0.6 \rangle$
$\langle 0.4, 0.6 \rangle \langle 0.8, 0.2 \rangle$

c) $P(A, C|B=T) = \alpha \langle P(A=T, C=T, B=T),$
$P(A=F, C=T, B=T), P(A=T, C=F, B=T),$
$P(A=F, C=F, B=T) \rangle$
$= \alpha \langle 0.048, 0.012, 0.196, 0.294 \rangle$
$= \langle 0.087, 0.022, 0.356, 0.534 \rangle$

- $P(A, C \mid B=F) = \alpha \langle P(A=T, C=T, B=F), P(A=F, C=T, B=F), P(A=T, C=F, B=F), P(A=F, C=F, B=F) \rangle$

$= \alpha \langle 0.192, 0.048, 0.084, 0.126 \rangle$

$= \langle 0.427, 0.107, 0.187, 0.28 \rangle$.

d) Given B, is A conditionally independent of C?

→ For A to be conditionally independent of C

$P(A \mid B, C) = P(A \mid B)$.

$P(A \mid B, C) = \langle 0.8, 0.2 \rangle \langle 0.4, 0.6 \rangle$
$\langle 0.4, 0.6 \rangle \langle 0.8, 0.2 \rangle$

$P(A \mid B) = \langle 0.444 \quad 0.556 \rangle \quad \langle 0.613 \quad 0.387 \rangle$

$P(A \mid B, C) \neq P(A \mid B)$.

$\therefore$ A is not conditionally idependent of C, given B.