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ASSIGNMENT-8

1

a) Let M - Sensor in Maine

T - Daily high ≥ 80 degree

$P(M) = 0.05$ $\quad P(\neg M) = 0.95$

$P(T/M) = 0.2$ $\quad P(T/\neg M) = 0.9$

To find $P(M/\neg T)$

$\propto P(M/\neg T)$

$= \alpha \propto P(\neg T/M) P(M)$

$= \alpha \propto 0.8 \times 0.05$

$= \alpha \propto 0.04$

$= \propto 0.2963$

$P(\neg M/\neg T) >$

$P(\neg T/\neg M) P(\neg M) >$

$0.1 \times 0.95 >$

$0.095 >$

$0.7037 \quad \alpha = 1/0.135$

$P(M/\neg T) = 0.2963$ //

29.63% prob sensor is in Maine //

b) $P(\neg T_2/\neg T_1) = \dfrac{P(\neg T_2 \wedge \neg T_1)}{P(\neg T_1)}$

$$P(\neg T_1) = P(\neg T_1/M)\,P(M) + P(\neg T_2/\neg M)\,P(\neg M)$$

$$P(\neg T_2 \wedge \neg T_1) = P(\neg T_2 \wedge \neg T_1/M)\,P(M) + P\left(\neg T_2 \wedge \frac{\neg T_1}{\neg M}\right) P(\neg M)$$

$$= P(\neg T_2/M)\,P(\neg T_1/M)\,P(M) + P(\neg T_2/\neg M)\,P(\neg T_1/\neg M)\,P(\neg M)$$

$$= 0.8 \times 0.8 \times 0.05 + 0.1 \times 0.1 \times 0.95$$

$$= 0.0415$$

$$P(\neg T_2/\neg T_1) = \frac{0.0415}{0.135} = 0.3074 \;//$$

c) $P(\neg T_3 \wedge \neg T_2 \wedge \neg T_1)$

$$= P(\neg T_3 \wedge \neg T_2 \wedge \neg T_1/M)\,P(M) + P(\neg T_3 \wedge \neg T_2 \wedge \neg T_1/\neg M)\,P(\neg M)$$

$$= P(\neg T_3/M)\,P(\neg T_2/M)\,P(\neg T_1/M)\,P(M) + P(\neg T_3/\neg M)\,P(\neg T_2/\neg M)\,P(\neg T_1/\neg M)\,P(\neg M)$$

$$= 0.8 \times 0.8 \times 0.8 \times 0.05 + 0.1 \times 0.1 \times 0.1 \times 0.95$$

$$= 0.0256 + 0.00095 = 0.02655 \;//$$

2)

a) $P(A, B_1, B_2, \ldots, B_{10})$

A can have 5 values Each B can have 7 values

Joint prob needs $5^1 \times 7^{10}$ numbers or $5^1 \times 7^{10} - 1$ numbers.

b) using conditional Prob

$$P(A, B_1, B_2, \ldots B_{10}) = P\left(\frac{B_1}{A}\right) P\left(\frac{B_2}{A}\right) \ldots P\left(\frac{B_{10}}{A}\right) P(A)$$

Each $P(B_i/A)$ needs $5 \times (7-1) = 30$ values

$P(A)$ needs $5 - 1 = 4$ values

So we only need $30 \times 10 + 4 = 304$ values

3) Attached as pdf

4) Attached as xls file

5)

a) G, P, Q, K, M

b) $P(A,F) = P(F,A) = P(F/A)\,P(A)$

$= 0.8 \times 0.8 = 0.64$ //

c) $P(M, \overline{7C}/H) = \dfrac{P(M, \overline{7C}, H)}{P(H)}$

$P(M, \overline{7C}, H) = P(M, H, \overline{7C})$

$= P(M/H)\,P(H/\overline{7C})\,P(\overline{7C})$

$= 0.1 \times 0.1 \times 0.4 = 0.004$ //

$P(H) = P(H/C)\,P(C) + P(H/\overline{7C})\,P(\overline{7C})$

$= 0.6 \times 0.6 + 0.1 \times 0.4$

$= 0.36 + 0.04 = 0.4$ //

$P\left(M \,\&\, \dfrac{\overline{7C}}{H}\right) = \dfrac{0.1 \times 0.1 \times 0.4}{0.4}$

$= 0.01$ //