5)

a) I, R, S, M, O

c)

$$P(M, not(c) | H) = P(M, \neg C, H) / P(H)$$
$$= P(M|H)\ P(H|\neg C)\ P(\neg C)$$
$$= 0.1 \times 0.1 \times 0.4$$
$$= 0.004$$

$$P(H) = P(H|C) P(C) + P(H|\neg C) P(\neg C)$$
$$= (0.6 \times 0.6) + (0.1 \times 0.4)$$
$$= 0.36 + 0.04$$
$$= 0.40$$

$$P(M, \neg C | H) = \frac{0.1 \times 0.1 \times 0.4}{0.4}$$
$$= 0.01$$

b) $P(I, D) = P(I|D)\ P(D)$
$$= 0.5 \times 0.5$$
$$= 0.25.$$

1) P of sensor in Maine $P(M) = 0.05$
P of Sensor in Sahara $P(S) = 0.95$
P of getting daily high temp of 80' or above $= 0.20$
$P(T|M) = 0.20$
P of getting daily high temp of 80' or above $= 0.90$
in Sahara $P(T|S) = 0.90$

a) $$P(M|T) = \frac{P(M)\,P(T|M)}{P(T)}$$

$$= \frac{P(M)\,P(T/M)}{P(M)\,P(T|M) + P(S)\,P(T|S)}$$

$$= \frac{0.05 \times 0.2}{(0.05 \times 0.2) + (0.95 \times 0.9)}$$

$$= 0.0115$$

b) probability of M = 1.15%
probability of S = 98.85%
H: High of 80°

$$P(H) = (0.0115 \times 0.2) + (0.9885 \times 0.9)$$
$$= 0.8916$$

c) $P(T_1 \geq 80 \cap T_2 \geq 80 \cap T_3 \geq 80)$

$$= P(T_1 \geq 80 \cap T_2 \geq 80 \cap T_3 \geq 80 \mid SP = M) \cdot P(SP = M)$$
$$+ P(T_1 \geq 80 \cap T_2 \geq 80 \cap T_3 \geq 80 \mid SP = S) \cdot P(SP|S)$$

considering Naive Baye's assumption,

$= P(T_1 \geq 80 | SP=M) \cdot P(T_2 \geq 80 | SP=M) \cdot P(T_3 \geq 80 | SP=M) \cdot P(SP=M)$
$+ P(T_1 \geq 80 | SP=S) \cdot P(T_2 \geq 80 | SP=S) \cdot P(T_3 \geq 80 | SP=S) \cdot P(SP=S)$

$= (0.20 \times 0.20 \times 0.20 \times 0.05) + (0.90 \times 0.90 \times 0.90 \times 0.95)$

$= 0.0004 + 0.69255$

$= 0.69295$

69.295%

2)

a) total 11 variables

A → 6 values

B1, B2, ... B10 → 5 values

Total = A × B1 × B2 × ... × B10 $= 6 \times 5^{10}$

or $6 \times 5^{10} - 1$ numbers.

b) conditional probability

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

$P(B_1|A)$ needs $(5-1) \times 6 = 24$ values

$P(A)$ needs $6-1 = 5$ values

Total : $(24 \times 10) + 5 = 245$ values.