2. Given, Precipitation, temperature, schools, counties.
P T S C

P_N : New value for precipitation
P_{GT} : New value is greater than current value
T_N : New value for Temperature
T_{LT} : New value is less than current value
P_R : Precipitation Record Broken
T_R : Temperature Record Broken
S_C : Schools closed
N_1 : Number of days = 1
N_2 : Number of days = 2
N_3 : Number of days $\geq$ 2
C_n : Any n^{th} county in the state
C_A : All counties in the state

One record rule:

$$(C_n \wedge ((P_N \wedge P_{GT}) \rightarrow P_R)) \vee (C_n \wedge ((CT_N \wedge T_{LT}) \rightarrow T_R)) \rightarrow S_C \wedge N_1$$

Two record rule:

$$((C_n \wedge ((P_N \wedge P_{GT}) \rightarrow P_R)) \wedge (C_n \wedge ((CT_N \wedge T_{LT}) \rightarrow T_R)) \rightarrow S_C \wedge N_2$$

state-wide-rules:

$$((C_{Cn} \wedge (C_{PN} \wedge P_{QT}) \rightarrow P_R)) \wedge (G_n \wedge ((C_{TN} \wedge T_{LT}) \rightarrow T_R) \rightarrow S_C \wedge N_2) \wedge$$
$$((C_{Cn} \wedge (C_{PN} \wedge P_{QT}) \rightarrow P_R)) \wedge (C_{Cn} \wedge ((C_{TN} \wedge T_{LT}) \rightarrow T_R) \rightarrow S_C \wedge N_2) \wedge$$
$$((C_{Cn} \wedge (C_{PN} \wedge P_{QT}) \rightarrow P_R)) \wedge (C_{Cn} \wedge ((C_{TN} \wedge T_{LT}) \rightarrow T_R) \rightarrow S_C \wedge N_2) \vee$$
$$((C_{Cn} \wedge (C_{PN} \wedge P_{QT}) \rightarrow P_R)) \wedge (C_{Cn} \wedge ((C_{TN} \wedge T_{LT}) \rightarrow T_R) \rightarrow S_C \wedge N_2)) \rightarrow S_C \wedge C_A$$

3(a) $P(+sc \mid +s) = \dfrac{P(+sc, +s)}{P(+s)}$

$= \dfrac{1}{P(+s)} \sum_{T,P,C} P(+sc, +s, T, P, C)$

$= \dfrac{1}{P(+s)} \sum_{T,P,C} P(+s) P(+sc \mid +s, C) P(T) P(P) P(C \mid T, P)$

$= \dfrac{P(+s)}{P(+s)} \sum_{TPC} P(+sc \mid +s, C) P(T) P(P) \dfrac{P(C, T, P)}{P(T, P)}$

$= \sum_{TPC} P(+sc \mid +s, C) P(T) P(P) \dfrac{P(C, T, P)}{P(T) P(P)}$

$= \sum_{TPC} P(+sc \mid +s, C) P(C, T, P)$

$= P(+sc \mid +s, +c) P(+c, +T, +P) + P(+sc \mid +c, +s) P(+c, +T, -P)$
$+ P(+sc \mid +s, +c) P(+c, -T, +P) + P(+sc \mid +c, +s) P(+c, -T, -P)$
$+ P(+sc \mid +s, \bar{+}c) P(-c, +T, +P) + P(+sc \mid \bar{-}c, +s) P(-c, +T, -P)$
$+ P(+sc \mid +s, -c) P(-c, -T, +P) + P(+sc \mid -c, +s) P(-c, -T, -P)$

$\left[\because P(A, B, C) = P(A \mid B, C) \times P(B) \times P(C) \right.$
$\left. \therefore P(\pm c, \pm T, \pm P) = P(\pm c \mid \pm T, \pm P) \times P(\pm T) \times P(\pm P) \right]$

$= 0.98 \times 0.98 \times 0.01 \times 0.04 + 0.98 \times 0.99 \times 0.96 \times 0.01 +$
$0.98 \times 0.99 \times 0.99 \times 0.04 + 0.98 \times 0.05 \times 0.99 \times 0.96 +$
$0.8 \times 0.02 \times 0.01 \times 0.04 + 0.8 \times 0.01 \times 0.96 \times 0.01 +$
$0.8 \times 0.01 \times 0.99 \times 0.04 + 0.8 \times 0.95 \times 0.99 \times 0.96$

$= 0.00038416 + 0.00931392 + 0.03841992 + 0.0465696 +$
$0.0000768 + 0.0003168 + 0.722304$
0.0000064

$\therefore P(+sc/+s) = 0.81739 16$

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3(b) $P(+sc / +c, +T, +P)$ (+ refers to condition being true)

$$= \frac{P(+sc, +c, +T, +P)}{P(+c, +T, +P)}$$

$$= \frac{\sum_s P(s, +sc, +c, +T, +P)}{P(+c, +T, +P)}$$

$$= \frac{\sum_s P(s)\, P(+sc/s, +c)\, P(+T)\, P(+P)\, P(+c/+T, +P)}{P(+c, +T, +P)}$$

$$= \frac{\sum_s P(s)\, P(+sc/s, +c)\, P(+T)\, P(+P)\, \frac{P(+c, +T, +P)}{P(+T, +P)}}{P(+c, +T, +P)}$$

$$= \frac{\sum_s P(s)\, P(+sc/s, +c)\, P(+T)\, P(+P)\, \frac{(P(+c, +T, +P))}{P(+T)\, P(+P)}}{P(+c, +T, +P)}$$

$$= \frac{P(+c, +T, +P)}{P(+c, +T, +P)} \sum_s P(s)\, P(+sc/s, +c)$$

$$= \sum_s P(s)\, P(+sc/s, +c)$$

$$= P(+s)\, P(+sc/+s, +c) + P(-s)\, P(+sc/-s, +c)$$

$$= 0.001 * 0.98 + 0.999 * 0.9$$

$$= 0.00098 + 0.8991$$

$$= 0.90008$$

$\therefore P(+sc/+c, +T, +P) = 0.90008$