Task 1

Knowns given problem statement: (M=Maine, S=Sahara, H=Hot(>=80), C=Cold(<80))

* P(M) = 0.0500
* P(S) = 0.9500
* P(H|M) = 0.2000, P(C|M) = 0.8000
* P(H|S) = 0.9000, P(C|S) = 0.1000

Calculated values:

* P(H) = P(H|M)\*P(M)+P(H|S)\*P(S) = 0.8650
* P(C) = P(C|M)\*P(M)+P(C|S)\*P(S) = 0.1350

1. P(M|C) = P(C|M)\*P(M)/P(C) = **0.2963**
2. If you know the previous day showed a cold temperature, the probabilities for the locations changes for the second calculation: P(M) <- P(M|C) = 0.2963, P(S) <- P(S|C)= 0.7037. Now just do sum rule again but replace the probabilities of the locations.  
   P(C2) = P(C|M)\*P(M|C)+P(C|S)\*P(S|C) = **0.3074**
3. Get the probabilities of P(M|C) and P(S|C) for the second day using the appropriate probabilities given the first day was cold.  
   P(M|C2) = P(C|M)\*P(M|C)/P(C2) = 0.7711  
   P(S|C2) = P(C|S)\*P(S|C)/P(C2) = 0.2290Now calculate P(C) with sum rule again  
   P(C3) = P(C|M)\*P(M|C2)+P(C|S)\*P(S|C2) = **0.6398**

Task 2

**P is possibly a probability function.** A probability function must sum up to 1.0 over all possibilities. since P(A)+P(B)=0.9, as long as P(C)+P(D)<=0.1 then its valid, but if not then its invalid.

Task 3

**P is definitely not a probability density function.** Probability density functions have a cumulative sum of 1.0. The total probability of P is 0.3\*(10-0) = 3.0. Since this is larger than 1.0 and negative probabilities don’t exist, P is invalid.

Task 4

Task 5

Completed in naive\_bayes.py.