Task 1 (20 points, written)

You are a meteorologist that places temperature sensors all of the world, and you set them up so that they automatically e-mail you, each day, the high temperature for that day. Unfortunately, you have forgotten whether you placed a certain sensor S in Maine or in the Sahara desert (but you are sure you placed it in one of those two places) . The probability that you placed sensor S in Maine is 5%. The probability of getting a daily high temperature of 80 degrees or more is 20% in Maine and 90% in Sahara. Assume that probability of a daily high for any day is conditionally independent of the daily high for the previous day, given the location of the sensor.

Part a: If the first e-mail you got from sensor S indicates a daily high under 80 degrees, what is the probability that the sensor is placed in Maine?

Part b: If the first e-mail you got from sensor S indicates a daily high under 80 degrees, what is the probability that the second e-mail also indicates a daily high under 80 degrees?

Part c: What is the probability that the first three e-mails all indicate daily highs under 80 degrees?

Task 2 (5 points, written)

Function P is a function defined on a set of samples S = {A, B, C, D}. We do not know the value of P for all samples, but we know that P(A) = 0.3 and P(B) = 0.6. What can you say about whether P is a valid probability function? Is P definitely a probability function, possibly a probability function, or definitely not a probability function? Justify your answer.

Task 3 (5 points, written)

Function P is a function defined on the set of real numbers. We do not know the value of P for all cases, but we know that P(x) = 0.3 when 0 <= x <= 10. What can you say about whether P is a valid probability density function? Is P definitely a probability density function, possibly a probability density function, or definitely not a probability density function? Justify your answer.