Austen Hsiao
985647212

TASK 1

From the problem:

P(Portland) = 0.05
P(Sahara) = 0.95
P(>80 | Portland) = 0.20
P(<80 | Portland) = 0.80
P(>80 | Sahara) = 0.90
P(<80 | Sahara) = 0.10

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 Portland?

$$P(\text{Portland} \mid <80) = \frac{P(<80 \mid Portland) * P(Portland)}{P(<80)} = \frac{0.80 * 0.05}{P(<80)}$$

P(<80) = P(<80 | Portland)*P(Portland) + P(<80 | Sahara)*P(Sahara)
= 0.80 * 0.05 + 0.10 * 0.95 = 0.135

$$P(\text{Portland} \mid <80) = \frac{0.80 * 0.05}{0.135} = \mathbf{0.296}$$

b. In the context of the problem, we assume conditional independence of daily high temperatures between different days

$P(\text{Email}_2 = <80 \mid \text{Email}_1 = <80) = P(\text{Email}_2 = <80)$ because of conditional independence

$P(\text{Email}_2 = <80)$ = P(<80 | Portland)*P(Portland) + P(<80 | Sahara)*P(Sahara)
= 0.80 * 0.05 + 0.10 * 0.95
= **0.135**

c. $P(\text{Email}_3 = <80) \wedge P(\text{Email}_2 = <80) \wedge P(\text{Email}_1 = <80) = P(<80)^3 = 0.135^3 = \mathbf{0.00246}$

TASK 2

P(A) = 0.3
P(B) = 0.6
P(C) = ?
P(D) = ?

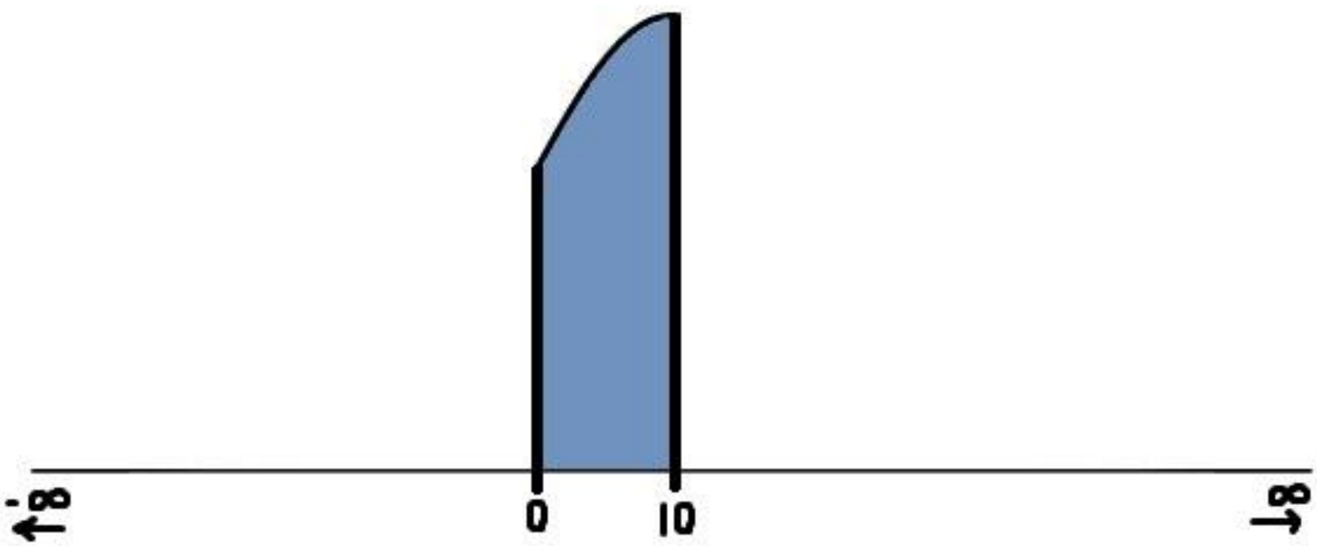
P *could* be a valid probability function. The only criteria for a probability function on a discrete set are that the probabilities are specific values contained by [0,1] and that the sum of all probabilities is unity. P would be a valid probability function if the sum of P(C) and P(D) equal 0.1 and, individually, are positive values.

Since the values of P(C) and P(D) are unknown, we cannot make the claim that P is definitively (or definitively not) a probability function. We can only make the claim that it *could* be a probability function.

TASK 3

Just as I did in task 2, we will evaluate the possibility of the current information matching with the requirements of a probability density function. A valid probability density function will always be positive and the sum area under the entire curve must be unity.

We are told that the function P is defined on the set of real numbers $(-\infty, \infty)$, and that $P(x) = 0.3$ for $0 <= x <= 10$. The picture below represents the scenario. The shaded region bounded by $x = [0, 10] = 0.3$.



From the given information, it is possible for the function to be a probability density function. As long as the curve outside of [0, 10] is positive and the total area under the entire curve equals 1, it will be valid. In its current state, we cannot definitively claim that P is or is not a probability density function, but it very well could be.

TASK 4

classification_accuracy=0.4483