

E7 spec sheet:

bayesCalculator

Mission command preamble: As in general, we won't tell you *how* to do something. That is up to you and your creative problem solving skills. However, we will tell you what we would like this function to do. So here are the specs of the function we would like you to write.

Purpose: Bayes theorem allows to invert conditional probabilities, which is extremely useful to optimally update pre-existing beliefs with new information. Thus, Bayesian methods are used in a wide range of applications. However, whereas it has been proposed that people are natural Bayesians (e.g. Kording & Wolpert, 2004; Stocker & Simoncelli, 2006), it has also been demonstrated that most people are not generally able to do such calculations explicitly (e.g. Hoffrage et al., 2000). Thus, it is important to have a readily available Bayesian calculator – that can be used to calculate Bayesian probabilities.

Specific things we would like this function to do:

- a) Take in four inputs as arguments, in this order: a: The prior probability of A, b: The prior probability of B, c: The likelihood (the probability of B given A) and d: A flag (the number 1 or 2) whether this function will implement 1) the simple or 2) the explicit version of Bayes theorem. If the flag is set to 2 (the explicit version), input argument b should be interpreted as “the probability of B given not A”, instead of the prior probability of B.
- b) Regardless of the flag, the function should calculate the posterior probability of A given B from the information given in the input arguments.
- c) The function should return the value computed in b)
- d) Assumptions: The input arguments should be real numbers from 0 to 1 for input arguments a to c and the integers 1 or 2 for input argument d, as stated in a).
- e) Make sure the function has a clear header as to what inputs the function assumes, what outputs it produces and when it was written.

Hints:

- 1) This should be rather straightforward. Make sure the function implements the two equations presented in the Bayes theorem lecture, based on the flag that was set in input argument d.
- 2) Make sure to distinguish prior probabilities, likelihoods and posterior probabilities

Input / output examples:

Input: bayesCalculator(0.01,0.1,0.99,1)	Output: 0.099
Input: bayesCalculator(0.01,0.1,0.99,2)	Output: 0.0909
Input: bayesCalculator(0.0001,0.01,1,1)	Output: 0.01
Input: bayesCalculator(0.06,0.1,0.95,2)	Output: 0.3775
Input: bayesCalculator(0.3775,0.33,0.9,2)	Output: 0.6232
Input: bayesCalculator(0.05,0.0625,1,1)	Output: 0.8
Input: bayesCalculator(0.05,0.0625,0.8,1)	Output: 0.64
Input: bayesCalculator(0.3,0.01,0.95,2)	Output: 0.9760
Input: bayesCalculator(0.3,0.25,0.5,2)	Output: 0.4615