STAT 431 — Applied Bayesian Analysis — Fall 2022

Homework 1

Due: September 9, 11:59 PM (US Central)

1. [4 pts] BSM, Section 1.6, Exercise 8. For each part, show your work or justify your answer. Important: The uniform distributions you use should be *continuous*, not discrete!

2. Read BSM, Section 1.6, Exercise 10. Do **NOT** answer the parts of that exercise, but instead answer the following parts:

   (a) [4 pts] For each of the following, give a corresponding expression of the form "Prob($\cdots$)" in terms of X_1 and/or X_2.

   (i) the probability that the tree species occupies the forest

   (ii) the conditional probability that the researcher gathers no trees of that species, given that the tree species occupies the forest

   (iii) the probability that the researcher gathers no trees of that species

   (iv) the conditional probability that the tree species occupies the forest, given that the researcher gathers no trees of that species

   (b) [7 pts] For each of the four probabilities in the previous part, find a mathematical formula in terms of n, θ, and/or λ. Show work where needed.

3. GRADUATE SECTION ONLY

   [5 pts] Let X have an exponential distribution with mean 1, and let the conditional distribution of Y given $X = x$ be Poisson with mean x.

   (a) Write out the marginal density of X and the conditional density of Y given $X = x$.

   (b) Derive the marginal density of Y.

   (c) Name the marginal distribution of Y.