Homework 1

Question 1:

a. Use PreliZ to compute the moments for the SkewNormal distribution for a combination of parameters.
b. Generate random samples of different sizes, like 10, 100, and 1,000, and see if you can recover the values of the first two moments (mean and variance) from the samples. What do youobserve?
c. Repeat the for the Student's t-distribution. Try values of ν like 2, 3, 500. What do you observe?

Question 2:

Let's suppose that we have two coins; when we toss the first coin, half of the time it lands on tails and half of the time on heads. The other coin is a loaded coin that always lands on heads. If we take one of the coins at random and get a head, what is the probability that this coin is the unfair one?

Question 3:

The following definition of a probabilistic model is given:

$$Y \sim Normal(\mu, \sigma)$$

$$\mu \sim Normal(0, 2)$$

$$\sigma \sim HalfNormal(0.75)$$

a. Identify the prior and the likelihood.
b. How many parameters will the posterior have? Explain.
c. Write Bayes' theorem for the model.
d. Create a diagram to visualize the model.

Question 4:

a. Use Preliz to choose the parameters of a Beta prior for a case in which we have no prior idea if a coin is fair or not.

b. Use Preliz to choose the parameters of a Beta prior for a case in which we think the coin may be fair.
c. We conduct a coin flipping experiment five times, and got two heads. Please present the posterior distribution and the mode. Do this for each of the two priors.
d. We conduct an additional 50 coin flips, out of which 28 were heads. Please present the posterior distribution and its mode for each of the two priors.
e. Discuss your conclusions about the effect of the prior and the amount of data.