SCHOOL OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF DATA SCIENCE AND ANALYTICS

FALL 2024 – QUIZ 2

COURSE CODE: STA 4030A

UNIT NAME: BAYESIAN INFERENCE ND DECISION THEORY

DATE: 29TH SEPTEMBER 2024   **TOTAL MARKS**: 30 MARKS

INSTRUCTIONS:

For this exercise:

1. ANSWER ALL QUESTIONS
2. Do all your working in the Rmarkdown (.rmd).
3. Submissions should be in a `.rmd` file
4. NO SUBMISSIONS SHOULD BE DONE VIA EMAIL

QUESTIONS:

1. Tarone (1982) reports data from 71 studies on tumor incidence in rats.

    a. In one of the studies, 2 out of 13 rats had tumors. Assume there are 20 possible tumor probabilities: 0.025, 0.075, ..., 0.975. Assume that the tumor probability is uniformly distributed. Find the posterior distribution for the tumor probability given the data for this study.
    b. Repeat Part a for a second study in which 1 in 18 rats had a tumor.
    c. Parts a and b assumed that each study had a different tumor probability, and that these tumor probabilities were uniformly distributed a priori. Now, assume the tumor probabilities are the same for the two studies, and that this probability has a uniform prior distribution. Find the posterior distribution for the common tumor probability given the combined results from the two studies.
    d. Compare the three distributions for Parts a, b, and c. Comment on your results.

2. In an experiment, subjects were given the choice between two gambles:

    Gamble 1:

A:	$2500 with probability 0.33 $2400 with probability 0.66 $0 with probability 0.01		B:	$2400 with certainty

    Suppose that a person is an expected utility maximizer. Set the utility scale so that u($0) = 0 and u($2500) = 1. Whether a utility maximizing person would choose Option A or Option B depends on the person's utility for $2400. For what values of u($2400) would an expected utility maximizer choose Option A? For what values would an expected utility maximizer choose Option B?

    Gamble 2:

C:	$2500 with probability 0.33 $0 with probability 0.67		D:	$2400 with probability 0.34 $0 with probability 0.66

    For what values of u($2400) would an expected utility maximizer choose Option C? For what values would an expected utility maximizer choose Option D?