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Exercise 2.3
Multivariate Conjugate Prior Distributions

Instructions: You may discuss this assignment with other students in the class, but you must submit your own answers to the questions below. Include an honor pledge with your submission. Submit online and in PDF. This exercise is ungraded.

1. Determine characteristics that contribute to vehicular accidents using accident report data as follows.

   The reports have 3 variables: drunk (d), texting (t), and crash outcome (c), where $d, t \in \{0, 1\}$ and

   $$c = \begin{cases} 0 & \leq \$5k \text{ damages} \\ 1 & > \$5k \text{ damages and no injury or death} \\ 2 & \text{injury or death} \end{cases}$$

   Accident Data

d	t	c
1	1	2
1	0	0
0	1	1
0	1	0
1	1	2
0	0	0
1	0	1

2. You work as a data scientist for a small software-as-a-service (SAS) company. Your CEO asks you to estimate the average time, M_1 and the average number of full time people M_2, it will take to complete an addition to your main product. To do this, you assume $f((M_1, M_2)|\boldsymbol{w}) \sim N(\boldsymbol{\mu}_0, v\boldsymbol{w})$ with $E[\boldsymbol{\mu}_0 = (3, 4.5)$ (months and full time people) based on the equivalent of 3 observations (i.e., $v = 3$). Also, $f(\boldsymbol{w}) \sim \text{Wishart}(\boldsymbol{r}, \alpha)$ where $\alpha = 2$ and

   $$r = \begin{bmatrix} 1 & .5 \\ .5 & 1.5 \end{bmatrix}$$

   Find the marginal prior for (M_1, M_2)