Please show all your work, don’t just write down the final number.

- Reading: 8.2, 9.3, 7.2, handout on computing the expectation and variance by conditioning, 12.1 (optional, mathematical underpinning for 12.2, will not cover with such rigor in this course), 12.2

- Exercises 8.2.10(i-iii), 8.2.13, 9.3.9, 9.3.10, 12.2.6, 12.2.12, 12.2.15, 12.2.16, 12.2.21,

- Ross (8th edition, problems may or may not match the 7th edition)

7.45 If $X_1$, $X_2$, $X_3$, and $X_4$ are (pairwise) uncorrelated random variables, each having mean 0 and variance 1, compute the correlations of
   (a) $X_1 + X_2$ and $X_2 + X_3$;
   (b) $X_1 + X_2$ and $X_3 + X_4$.

7.49 There are two misshapen coins in a box; their probabilities for landing on heads when they are flipped are, respectively, $.4$ and $.7$. One of the coins is to be randomly chosen and flipped 10 times. Given that two of the first three flips landed on heads, what is the conditional expected number of heads in the 10 flips?

7.50 The joint density of $X$ and $Y$ is given by
   \[ f_{XY}(x,y) = \frac{e^{-x/y}e^{-y}}{y}, \quad 0 < x < \infty, \quad 0 < y < \infty \]

   Compute $E[X^2 | Y = y]$.

7.53 A prisoner is trapped in a cell containing 3 doors. The first door leads to a tunnel and returns him to his cell after 2 days’ travel. The second leads to a tunnel that returns him to his cell after 4 day’s travel. The third door leads to freedom after 1 day of travel. If it is assumed that the prisoner will always select doors 1, 2, and 3 with respective probabilities $.5$, $.3$, and $.2$, what is the expected number of days until the prisoner reaches freedom?

7.57 Suppose that the expected number of accidents per week at an industrial plant is 5. Suppose also that the numbers of workers injured in each accident are independent random variables with a common mean of 2.5. If the number of workers injured in each accident is independent of the number of accidents that occur, compute the expected number of workers injured in a week.

7.64 Type $i$ light bulbs function for a random amount of time having mean $\mu_i$ and standard deviation $\sigma_i$, $i = 1, 2$. A light bulb random chosen from a bin of bulbs is a type 1 with probability $p$ and a type 2 with probability $1 - p$. Let $X$ denote the lifetime of this bulb. Find
   (a) $E[X]$;
   (b) $Var(X)$.

7.65 The number of winter storms in a good year is a Poisson random variable with mean 3, whereas the number in a bad year is a Poisson random variable with mean 5. If the next year will be a good year with probability $.4$ or a bad year with probability $.6$, find the expected value and variance of the number of storms that will occur.
7.66 In Example 5c (handout), compute the variance of the length of time until the miner reaches safety.