1) Suppose that it takes at least 3 votes from a 4 member jury to convict a defendant. Also assume that the probability that a juror votes a guilty person innocent is 0.2, whereas the probability that a juror votes an innocent person guilty is 0.1. If each juror acts independently and 65% of defendants are guilty, find the probability that the jury renders a correct decision.

2) In answering a multiple choice exam question, a student either knows the correct answer or randomly guesses 1 of m alternatives. Let p be the probability that the students knows the answer. If the student gets the correct answer, then what is the probability that the student actually knew the answer?

3) A professor in an English course constructs a final exam by selecting four questions at random from a list of nine questions handed out in advance to the students. Suppose that a particular student has time to prepare answers to the first six of the nine questions. What is the probability that the student will be prepared for at least three of the four questions on the exam?

4) Let X and Y be random variables with a joint probability density function $f_{X,Y}(x,y) = e^{-(x+y)}$ for $0 \leq x, y < \infty$. Let $Z = X/Y$.
   a) Find the cumulative probability distribution function of Z and sketch its graph.
   b) Find the probability density function of Z and sketch its graph.

5) Let X and Y be independent random variables with variances σ_X^2 and σ_Y^2 respectively. For what value of λ does the random variable $Z = \lambda X + (1 - \lambda)Y$ have the smallest variance?

6) Let Z be a standard normal random variable and $W = Z^2$.
   a) Find $E[e^{tW}]$.
   b) Use the result of part (a) to find the variance of W.

7) Let X be a random variable with a Poisson distribution of parameter λ. Show that

$$P(X \text{ is even}) = \tfrac{1}{2}\left(1 + e^{-2\lambda}\right)$$

8) A fair die (one die) is rolled 420 times. Approximately what is the probability that the sum of all upturned faces exceeds 1540?