A. FROM ROSS 8TH EDITION CHAPTER TWO:

1. **Problem 25**: A pair of dice is rolled until a sum of either 5 or 7 appears. Find the probability that a 5 occurs first. *Hint.* Let $E_n$ denote the event that a 5 occurs on the $n$th roll and no 5 or 7 occurs on the first $(n - 1)$ rolls. Compute $P(E_n)$ and argue that $\sum_{i=1}^{\infty} P(E_n)$ is the desired probability.

2. **Problem 48**: Given 20 people, what is the probability that, among the 12 months in the year, there are 4 months containing exactly 2 birthdays and 4 containing exactly 3 birthdays?

3. **Problem 49**: A group of 6 men and 6 women is randomly divided into 2 groups of size 6 each. What is the probability that both groups will have the same number of men?

4. **Theoretical Exercise 10**: Prove that $P(E \cup F \cup G) = P(E) + P(F) + P(G) - P(E^cFG) - P(EF^cG) - P(EG^c) - 2P(EFG)$.

5. **Theoretical Exercise 15**: An urn contains $M$ white and $N$ black balls. If a random sample of size $r$ is chosen, what is the probability that it contains exactly $k$ white balls?

6. **Theoretical Exercise 20**: Consider an experiment whose sample space consists of a countably infinite number of points. Show that not all points can be equally likely. Can all points have a positive probability of occurring?

B. A deck of cards contains 30 cards with labels 1, 2, . . . , 30. Suppose that somebody is randomly dealt a set of 7 cards of these cards (numbered with seven distinct numbers).

1. Find the probability that 3 of the cards contain odd numbers and 4 contain even numbers.

2. Find the probability each of the numbers on the seven cards ends with a different digit. (For example, the cards could be 3, 5, 14, 16, 22, 29, 30.)

C. (Just for fun – not to hand in.) The following is a popular and rather instructive puzzle. A standard deck of 52 cards (26 red and 26 black) is
shuffled so that all orderings are equally likely. We then play the following game: I begin turning the cards over one at a time so that you can see them. At some point (before I have turned over all 52 cards) you say “I’m ready!” At this point I turn over the next card and if the card is red, you receive one dollar; otherwise you receive nothing. You would like to design a strategy to maximize the probability that you will receive the dollar. How should you decide when to say “I’m ready”?