

This week on the problem set you will get practice manipulating sets and applying them to probability models. Especially challenging questions, or questions that are not appropriate for an exam, are indicated with one or more asterisks.

1. From the textbook, chapter 1, problems 1, 4\*, 6, 7, 8, 10.
2. From the supplementary problems, chapter 1, problems 6, 9.
3. I have a standard deck of 52 cards ([https://en.wikipedia.org/wiki/Standard\\_52-card\\_deck](https://en.wikipedia.org/wiki/Standard_52-card_deck))
  - (a) I remove a card at random. What is the probability that it is a Jack?
  - (b) I remove a card at random. Given that it is a spade, what is the probability that it is a Jack?
  - (c) I remove a card at random. Given that it is a face card (Jack, Queen, King), what is the probability that it is a Jack?
  - (d) I remove a card at random and place it aside. I remove another card. What is the probability that it is a Jack?
  - (e) I remove 11 cards at random and place them aside. I remove another card. What is the probability that it is a Jack?
4. Suppose that I arrive at a bus stop at some time between 8:00 am and 8:25 am with uniform probability. Buses arrive at 8:03, 8:13, 8:23, 8:33, .... What is the probability that I need to wait more than 2 minutes?
5. Three friends, Pam, Jim and Michael take turns flipping a fair coin in that order. The first one to flip tails wins the game.
  - (a) Write down a model for this experiment.
  - (b) Describe the events “Pam wins”, “Jim wins”, “Michael wins”.
6. Show that the sample space of integers (whole numbers) cannot be given a uniform probability law.
7. (\*) There are  $n$  people standing in a line. Initially, the leftmost person is holding a potato. At each step, the person holding the potato passes it, with equal probability to one of their neighbors. Once the rightmost person receives the potato, the game ends.
  - (a) Describe the sample space.
  - (b) If  $n = 4$ , explicitly describe the event “the game ends within 5 steps”.
8. (\*\*) In the way indicated in the diagram below,  $n$  blocks are dropped, one at a time, into a “v”-shape container. The position at which the blocks are dropped is chosen at random. The resulting shape that the pile of blocks make is recorded. Describe the sample space, explicitly when  $n = 1, 2, 3, 4$  and 5. Can you find a nice description in general?

