
1. The lottery drawing is showing on TV. There are forty ping-pong balls numbered 1 through 40 bouncing around in a drum. The host picks out six balls without replacing any as they are drawn.

   (a) How many ways can this be done, if the order in which the balls are drawn doesn’t matter?

   (b) How many ways can this be done if the order does matter?

   Suppose now that if a ball is drawn from the drum, another ball with the same number is immediately placed in the drum to replace it.

   (c) How many ways can six balls be drawn now, if the order in which they are drawn doesn’t matter?

   (d) And how many ways if the order in which they are drawn does matter?

2. Your team has a big relay race coming up this weekend. It’s eight miles in total and you are allowed to split the milage amongst your teammates any way you like. The only requirement is that each teammate runs at most once during the race and for an integer number of miles. For the sake of argument, assume that the runners decide initially what order they will run in, and that all that remains is to divide up the milage among them.

   (a) Suppose you have three teammates and each one wants to run at least one mile. How many ways can this be done?

   (b) Suppose you have five teammates and none of them minds particularly if they don’t run at all. How many ways can you divide up the milage now?

   Suppose now that the race directors want the shorter and hence faster and more exciting legs to happen towards the end of the race. So they now require that each leg be no longer than the previous one (5 then 3 is allowed, 3 then 5 is not).
(c) Suppose you have three runners and each one wants to run at least one mile, how many ways can this happen now?

(d) Suppose you have five runners and none of them mind running 0 miles. How many ways can the race happen now?

(e) Same as part (d) but with eight runners.

3. You have 16 superballs (all the same) to give to 8 kids.

(a) How many ways can you do it?

(b) What if you want to be sure each kid gets at least one?
   Suppose instead of marbles its trading cards (all different).

(c) How many ways can you do it?

(d) What if each kid should get at least one?

4. How many ways can you divide up a class of 6 students into 3 presentation groups:

(a) all to present the same topic?

(b) all to present different topics?

(c) How many ways can you split the class up into any number of presentation groups (all to present the same topic)?

Not assigned yet, but you should also try problem 2.2.12 from the book.