Section 6.3
Simulating Experiments

Simulation is the imitation of a chance behavior based on a model that reflects an experiment.

When using random numbers to simulate a problem or experiment, we can use the random digit table or R.

Example 1: Mudlark Airlines has a 15-seater commuter turboprop that is used for short flights. Their data suggest that on average about 8% of the customers who buy tickets are no-shows. Wanting to avoid empty seats (they see this as missed opportunity to increase revenue), they decide to sell 17 tickets for each flight. Ticketed customers who cannot be seated on the plane will be accommodated on another flight and will receive a certificate good for a free flight at another time. You have been retained as a consultant to Mudlark. Your job is to determine if this particular overbooking is sound strategy. Use simulation methods to perform your analysis.

a. Describe a correspondence between the random digits from a random digit table and outcomes in this simulation. *This part is completely up to you, but you must write out how you will use the digits for the situation. However you do it, make sure the number of digits chosen at a time is equal.*

Here's one:
Note: We know that on average 8% are no- shows (N). So, we can do 00 – 07 to represent no-shows and 08 – 99 to represent shows (S).

b. Use line 115 of the random digit table for Flight 1 and line 116 for Flight 2.

115	55526	20038	12219	86208	07484	37662	54756	36799
116	18383	07966	51951	02466	17759	12817	95865	79200

shows

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Flight 1	55	52	62	00	38	12	21	98	62	08	07	48	43	76	62	54	75	
	S	S	S	N	S	S	S	S	S	S	N	S	S	S	S	S	S	15/17
Flight 2	18	38	30	79	66	51	95	10	24	66	17	75	91	28	17	95	86	
	S																S	17/17

We can also do random numbers in R.

R command: sample(a:b, "number of values needed"), where a, b are integers. If we need a random sample of real numbers then the R command is runif("number of values needed", a:b), where a, b are real numbers.
Let's try this…

Since this is a random sample of integers and we're not using the random digit table (which we'd need to keep the number of digits the same), we can use the integers 1 – 100. The numbers 1 – 8 can represent the no-shows and 9 – 100 can represent the shows.

Command/Result: sample(1:100, 17)

```
> sample(1:100,17)
 [1]  88  77   2  24 100  32  94   9  91  33  43  75  39  84  30  67  21
```

Flight: S S N S ⟵ S

16/17 => shows

Example 2: Assume that the percentage of women in a labor force of a large metropolitan area is 30%. We want to see if this is likely.
a. Assign the digits, 0 – 9 to represent the men and women in this situation. Describe how you will run the simulation using those digits and the random digit table.

0, 1, 2 => Women
3 – 9 => Men

b. Start on line 145 of the random digit table and carry out the simulation with three runs.

145	93509	07450	86916	98812	83180	27385	44180	08255
	R1		R2		R3			

Run 1	9	3	5	0	9	0	7	4	5	0	3/10
	M	M	M	W	M	W	M	M	M	W	
Run 2	8	6	9	1	6	9	8	8	1	2	3/10
	M	M	M	W	M	M	M	M	W	W	
Run 3	8	3	1	8	0	2	7	3	8	5	3/10
	M	M	W	M	W	W	M	M	M	M	

c. What is the expected number of women that should be hired, based on your simulation.

average # of W → runs → (3+3+3)/3 = 3