

A colorful illustration of the main characters from Disney's Beauty and the Beast. The Beast is on the left, Belle is on the right, and Lumiere, Cogsworth, Mrs. Potts, and Chip are in the center. Belle is holding a book. The background shows a window with red curtains and a view of a castle.

AP Statistics

Chapter 5: Probability

Day 6

HW: p. 295-297, #15, 17, 19, 23, 25

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Simulations of Random Phenomena

Sometimes one is interested in finding the probability distribution of a random phenomenon, but the situation is too complex to use other statistical methods.

Computing the probabilities algebraically or with diagrams may be very time consuming.

In these cases, simulation is a tool to answer the question.

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Simulations of Random Phenomena

Simulation is a method to model chance behavior that accurately mimics the situation being considered.

The mechanism used to determine outcomes is called a **chance device**.

A chance device can be a coin, dice, random digit table, or computer/calculator code that generates random values.

We will use a **random digit table** as our chance device because it is likely to appear on the AP exam.

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Conducting Simulations

To conduct a simulation, follow these five steps:

1. Describe the situation and its possible outcomes.
2. Identify how a chance device used will model the outcomes of the situation.
3. Describe what one trial of the experiment will be and what response variable will be recorded.
4. Conduct several trials of the experiment.
5. Analyze the distribution of the response variable and draw a conclusion.

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Example

Boxes of cereal contain collector cards of characters from a movie. Some cards are more common than others. The following distribution of the character cards in the boxes is given by the following:

Alfred the Agile: 20%
Brian the Brave: 30%
Craig the Crafty: 50%

What is the mean number of cereal boxes one would have to buy in order to get all three cards? Use a random digit table to conduct a simulation. Do five trials of your simulation.

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Example

A = 0-1
B = 2-4
C = 5-9

6
4
3
9
8

A B
00233

C/BC A
54830

BCA/C
39108

08996

A/B
14223

C A
39280

71405

49953

30324

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- ① Simulate opening cereal boxes until we get three different cards.
- ② We will use a random digit table. Each digit represents a box of cereal. Let $A = 0-1$, Let $B = 2-4$, Let $C = 5-9$.
- ③ Each trial will consist of selecting digits until all three cards have been selected. The response variable is the # of boxes.
- ④ We will conduct 5 trials.
- ⑤ In five trials, my results were 6, 4, 3, 9 and 8 boxes. The mean number of boxes is 6.

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Example

Fifteen students from a large high school have been selected to attend a meeting across town. Parents from the school have been asked to provide transportation to the event in their private cars and are to phone the school if interested. The school will accept calls until enough vehicles are obtained to transport the 15 students. The probability distribution on the next slide shows the number of passengers a car can hold, not including the driver, and the percentage of parents who own cars of that capacity.

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Example

Number of Passengers	1	3	4	6
Percentage of Cars	0.05	0.50	0.35	0.10

Handwritten notes above the table: 01-05, 06-55, 56-90, 91-99, 00. Handwritten notes below the table: 5, 50, 35, 10 = 100.

What is the average number of parents that will need to call to have enough transportation for 15 students? Use the random digit table below to conduct a simulation. Do five trials of your simulation starting each trial on a new line.

5 phone call	01405	49953	30324
	96080	51290	33843
	95945	04832	37520
	93015	93615	03413
	36370	10356	03768

Handwritten notes above the table: 1 3 3, 6 3.

