

Materials Needed:

Pair of dice.

When playing a game of “Craps”, what is the probability of winning, losing, or rolling a point on the first roll? Of winning or losing the game? Some of these probabilities can be very difficult to figure out theoretically, so simulations can be used to approximate the values.

1. Shoot craps 36 times. Record the outcomes of the games in the table below.

Game #	Sum on First Roll	Result of First Roll	Overall Result
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			

Game of Craps

1. Roll a pair of dice. If a sum of 7 or 11 occurs, you win; if a sum of 2, 3, or 12 arises, then you lose; any other sum is called a point.
2. If you roll a point on your first roll, then you must continue to roll the dice. If you roll your point again before rolling a 7 then you win; if you roll a 7 before you roll your point again then you lose.

Game #	Sum on First Roll	Result of First Roll	Overall Result
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			

2. Consider the sum of the dice on the *first roll*. Record the classical probabilities,

empirical probabilities for your group, and the empirical probabilities for the combined class data in the table as both fractions and decimals.

The classical probabilities is based on the number of ways each sum can be obtained, not on your results from playing craps. For example, there are 3 ways to get a sum of four ... 1-3, 2-2, or 3-1. So the classical probability of getting a sum of four is $3/36 = 0.08333$.

The group empirical probabilities are based on your 36 games in table 1. For example, let's say that the first roll was a five 8 times. Then the probability of getting a five would be $8/36 = 0.22222$.

The class probabilities are based on the combined results for the class, but it is similar to the group empirical probabilities. The major difference is there will be more than 36 tries.

Sum	Classical		Group		Class	
	Fraction	Decimal	Fraction	Decimal	Fraction	Decimal
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

3. Record the classical, group empirical, and class empirical probabilities of winning, losing, and rolling a point on the *first roll* of the dice. Write the values as both fractions and decimals.

You can add the probabilities from table 2 to get the probabilities in table 3. For instance, since a win is a seven or an eleven, add the probabilities for seven and eleven together to get the probability of winning on the first roll.

1st Roll Outcome	Win (7 or 11)		Lose (2, 3, or 12)		Point (4, 5, 6, 8, 9, or 10)	
	Fraction	Decimal	Fraction	Decimal	Fraction	Decimal
Classical						
Group						
Class						

4. Record the group and class results for the *overall result* in the table below.

Overall Result	Win		Lose	
	Fraction	Decimal	Fraction	Decimal
Classical	244/495	0.492929...	251/495	0.507070...
Group				
Class				

5. College Algebra can be used to show that the theoretical probability of winning a game of craps is approximately 0.493. A person should win slightly less than half of the time or lose slightly more than half of the time.
- Did your group win more games or lose more games?
 - Did the class win more games or lose more games?
6. Use the classical probabilities of winning and losing shown in part 4 to find the expected value of a craps game when \$5 is bet. (See 4.2.14 on pg 192)