Lesson 2 Part1: Examples for assigning and computing probabilities

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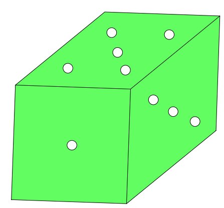
Please view the chapter 4 power point and read the chapter 4

We are going to review probability concepts with the use of simple examples.

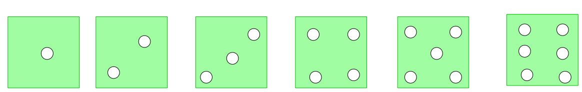
Example 1.

If we roll an ordinary six faced die, what is the probability that the face with two dots will show up?

A six faced die is a cube with 1,2,3,4,5,6 dots on the faces.



In the above phenomenon, the sample space (the set of all possible outcomes) is



or in simple terms
{1,2,3,4,5,6}

Since there are six equally likely outcomes, and 2 dots show up in only one of them,

P(the face with two dots will show up)$=\frac{1}{6}$

moreover:

P(number of dots facing up is even) $=\frac{3}{6}$

Example 2.

A mathematics department has 61 sections of different courses for this term.

Course	Number of Sections
Finite Mathematics	19
Statistics	15
Precalculus	9
Calculus I	7
Calculus II	6
Calculus III	2
Differential Equations	1
Linear Algebra	1
Abstract Algebra	1
	Total=61

If a section is selected at random for evaluation,

the probability that the course is precalculus is $\frac{9}{61}$

the probability that the course is not statistics$=\frac{61-15}{61} = \frac{46}{61}$

Example 3. Suppose that we have a group of five people named Alen, Bina, Chris, David and Erin. We would like to pick a simple random sample of three people from this group. Call the members of the group as A,B,C,D,E.

a) Let us look at the list of all possible samples of size 3Theyare

ABC ABD ABE ACD ACE ADE BCD BCE BDE CDE

b)We would like to find the probability that a sample containing Bina and Chris is selected.

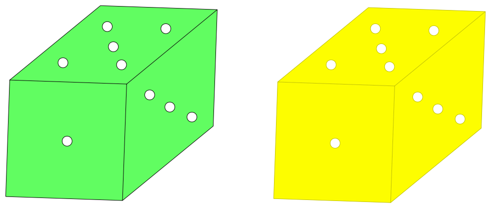
Note that there are three samples ABC, BCD, BCE containing Bina and Chris.

Therefore the probaility that a sample with Bina and Chris is selected is

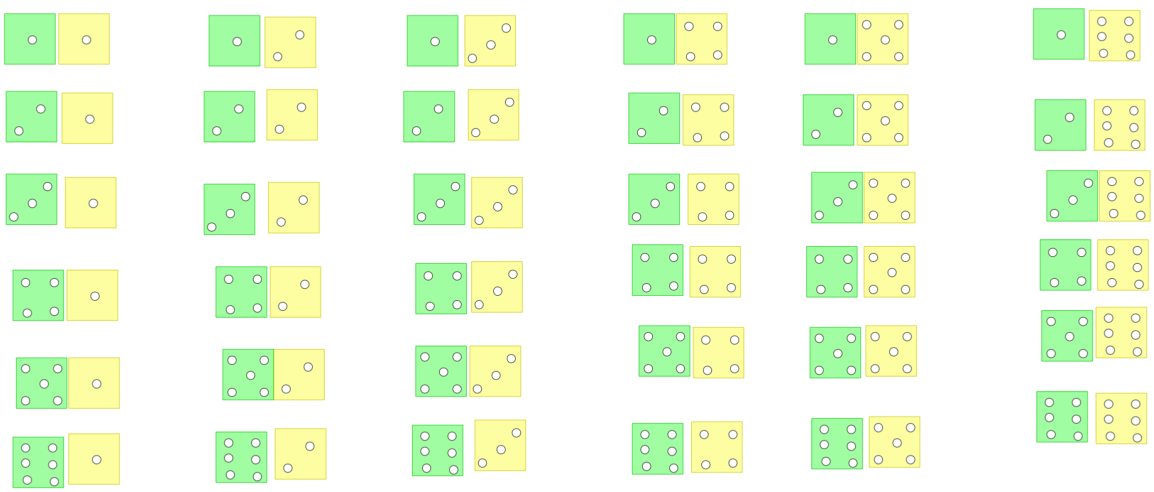
$\frac{1}{10}$.

Example 4.

If we roll two dice, for convenience, suppose one is green and one is yellow



the possible outcomes are



or in simple terms, it is

$$\begin{Bmatrix} (1,1),(1,2),(1,3),(1,4),(1,5),(1,6) \\ (2,1),(2,2),(2,3),(2,4),(2,5),(2,6) \\ (3,1),(3,2),(3,3),(3,4),(3,5),(3,6) \\ (4,1),(4,2),(4,3),(4,4),(4,5),(4,6) \\ (5,1),(5,2),(5,3),(5,4),(5,5),(5,6) \\ (6,1),(6,2),(6,3),(6,4),(6,5),(6,6) \end{Bmatrix}$$

Note that there are 36 outcomes.

If we have to calculate the probability that the sum of the dots facing up is 5.

note that there are 4 options that give a sum of 5,

$$\begin{Bmatrix} (1,1) & (1,2) & (1,3) & (1,4) & (1,5) & (1,6) \\ (2,1) & (2,2) & (2,3) & (2,4) & (2,5) & (2,6) \\ (3,1) & (3,2) & (3,3) & (3,4) & (3,5) & (3,6) \\ (4,1) & (4,2) & (4,3) & (4,4) & (4,5) & (4,6) \\ (5,1) & (5,2) & (5,3) & (5,4) & (5,5) & (5,6) \\ (6,1) & (6,2) & (6,3) & (6,4) & (6,5) & (6,6) \end{Bmatrix}$$

therefore the probability that the sum of the dots facing up is 5 is $\frac{4}{36}$

or P(sum of the dots facing up is 5)$=\frac{4}{36}$

similarly P(sum of the dots facing up is 6)$=\frac{5}{36}$

Sorry about the bad print
P(sum is 6) is 5/36

Let us look at a calculation the of the conditional probability of obtaining a sum of 6 given that both the dice have even number of dots facing up,

that is

P(sum is 6 given that both the dice have an even number of dots facing up.)

or

P(sum is 6 | both the dice have an even number of dots facing up.)

First, note that there are nine outcomes that show an even number of dots on both dice, out of which 2 give us a sum of 6

$$\begin{matrix} (1,1) & (1,2) & (1,3) & (1,4) & (1,5) & (1,6) \\ (2,1) & (2,2) & (2,3) & (2,4) & (2,5) & (2,6) \\ (3,1) & (3,2) & (3,3) & (3,4) & (3,5) & (3,6) \\ (4,1) & (4,2) & (4,3) & (4,4) & (4,5) & (4,6) \\ (5,1) & (5,2) & (5,3) & (5,4) & (5,5) & (5,6) \\ (6,1) & (6,2) & (6,3) & (6,4) & (6,5) & (6,6) \end{matrix}$$

therefore P(sum is 6 given that both the dice have an even number of dots facing up)$=\frac{2}{9}$

Example 5.

The following table gives the number of sections that a department at a university offers in on- line and face -to -face formats

Of their introductory level statistics courses.

	Face to Face	On Line	Total
General Statistics	7	8	15
Business Statistics	4	6	10
Statistics for Behavioral Sciences	3	12	15
Total	14	26	40

A course is randomly selected selected for review.

a) To find the probability that the course is Face to Face course:

Since 14 out of 40 courses are Face to Face, the probability is $\frac{14}{40}$.

b) To find the probability that a Business Statistics course is selected:

Since 10 out of 40 courses are Business Statistics courses, the probability is $\frac{10}{40}$

c) Given that the course selected is an online course, to find the probability that the course is a general statistics course.

OR

Find the probability of selecting a general statistics course, given that the course is an on line course.

There are total 26 on line courses out of which 8 are general statistics courses, therefore

the probability is $\frac{8}{26}$

Example 6.

Recall that events A and B are independent if P(A and B)=P(A)P(B)

this multiplication rule extends to more than two independent events.

Let us use this in the following example.

A big hall has five smoke detectors. The probability that any of the batteries will last for more than one year is 0.95. Assume that the lives of these batteries can be treated as independent from each other, and answer the following questions.

a) What is the probability that all of the batteries will last for more than one year?

Using the idependence, we can see that it is

$.95 \times .95 \times .95 \times .95 \times .95 = 0.77378$

b) What is the probability that at least one of these five batteries will last for less than one year.

Note that the event at least one of these five batteries will last for less than one year is the complement (opposite) of the event that all the batteries will last for more than one year.

i.e.

P(at least one fails)
$= 1 -$ **P(all suceed)**
$=1 - .77378 = 0.22622$