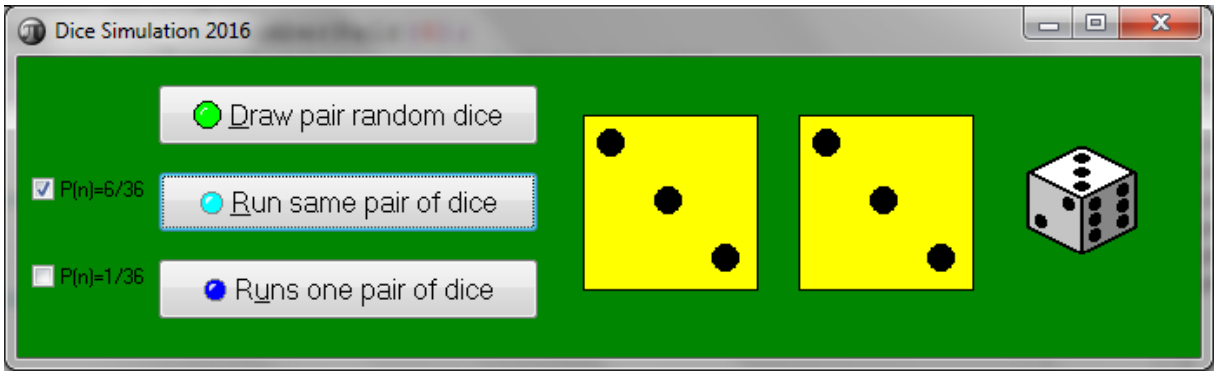
maXbox

maXbox Starter 10+

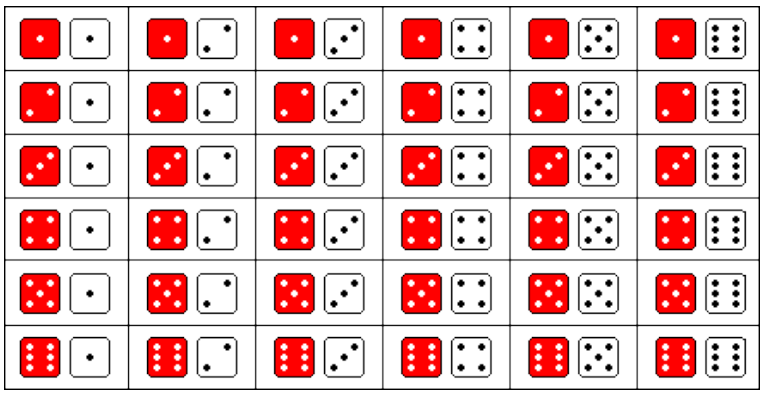
Introduction to Probability



1.1 Dice and the Law of Probability

Probability theory is required to describe nature and life. A revolutionary discovery of early 20th century physics was the random character of all physical processes that occur at sub-atomic scales and are governed by the laws of quantum mechanics.
But now you are playing a game which uses dice.
You are about to roll one of them and you need to roll at least a 6. Obviously the chances of rolling a 6 were **1/6** which is correct[1]..

Our next question will be to find out the probability to roll two same numbers with two dice. When two dice are rolled, there are now 36 different and unique ways the dice can land. You can get this result by multiplying the number of ways the first die appears (one..six) by the number of ways the second die appears (one..six). 6 x 6 = 36.



[1]rolling a 5,4,3,2 or 1 is also 1/6

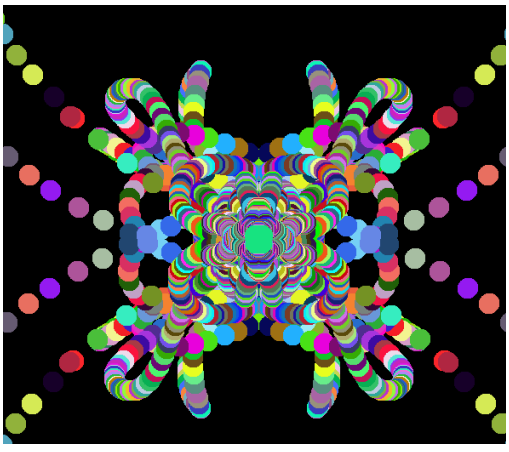
If you use the above graphic and count the number of times two same numbers appear when two dice are rolled (or one by one), you will see the answer is 6, each per column. Six times out of 36 or 16 %, the same as before because 6/36 is 1/6.
You can test that with the following script (app see above):

http://www.softwareschule.ch/examples/650_dice.txt

Load it in maXbox an press the second button it will run 150 times to simulate the rolling and in the end you get a result of about 0.166667. This should never be the same result, it depends each time on the random simulation.
Such an amusement; so let's use that same method to answer our second question and determine the chances of get just one pair of numbers, for example the 6 pair. Like before we do have 36 ways but only one pair of six! So, there are 1 out of 36 chances (1/36) of one pair of a 6 (or another dice number) which is about only 0.0278 probability. This you can test with the second button, and here's the code behind:

```
function DiceSimulation_OneNumberPair(anumb: byte): integer;
var size, offset, rand1, rand2:integer;
begin
  image1.canvas.brush.color:= form1.color;
  with image1 do canvas.fillrect(clientrect);
  size:= 9*image1.height div 10; {size 90% of height}
  offset:= image1.height div 20; {offset 5% of height}
  result:= 0;
  repeat
    rand1:= random(6)+1;
    rand2:= random(6)+1;
    inc(result)
    drawDie(image1,point(offset,offset),size,rand1); {draw 1st die}
    drawDie(image1,point(offset+image1.width div 2,offset),size,rand2);
  until rand1 and rand2 = anumb;
end;
```

The last test question is for real brains, how much is the probability to roll at least one 6 with two dice?
Once again the map above shows this; count the number of 6 appears when two dice are rolled, you will find the answer is 11. Eleven times out of 36 or 30.556 % is 11/36.



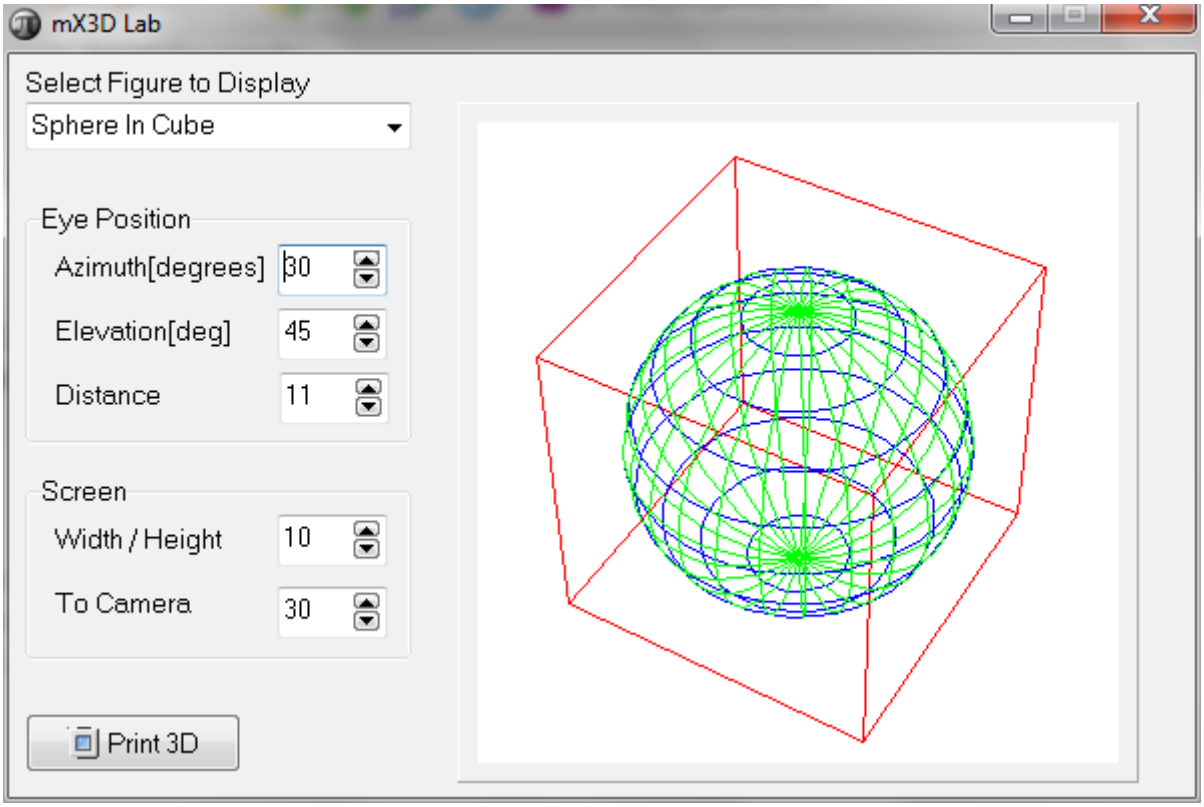
Albert Einstein famously remarked in a letter to Max Born: "I am convinced that God does not play dice".[20] (http://en.wikipedia.org/wiki/Probability)

Let's make the conclusion on the average:

Knowing how these formulas work is only half the battle. Figuring out how to interpret a real world situation can be quite hard. I hope the dice pattern can help you to decide:

1.	We role one dice to get a six	-> 1/6	16.66 %
2.	We role two dice to get a pair of same numbers	-> 6/36 (1/6)	16.66 %
3.	We role two dice to get a specific pair of numbers	-> 1/36	02.77 %
4.	We role two dice to get at least one specific number	-> 11/36	30.55 %

But at least you know how to calculate this 4 cases.




```
//maXbox: ..menu/Output/3D Lab
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Feedback @
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Literature: Kleiner et al., Patterns konkret, 2003, Software & Support
Links of maXbox and Statistics:

http://www.softwareschule.ch/download/maxbox_starter10.pdf

https://en.wikipedia.org/wiki/Probability_theory

https://github.com/maxkleiner/maXbox3/releases