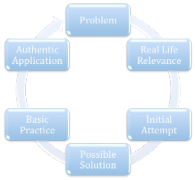
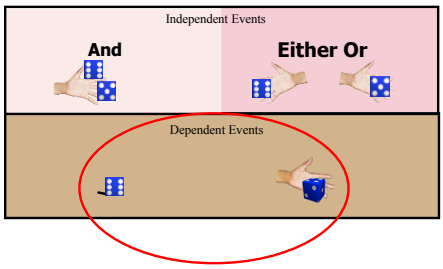
The finance department of your firm has been asked to provide financial projections for next year. Economists are predicting a 30% chance of a recession. Historically, your firm makes 20% of its profit during economic recessions.

Given that there is a recession, what is the probability of your firm making a profit?



Introductory Probability

Dependent Events

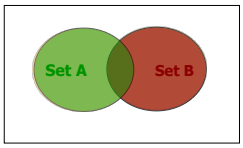


"Dependent" = Conditional

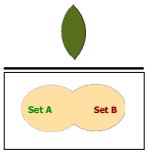
What is the probability of getting a score greater than 8 (9 or above) when rolling two six sided dice?

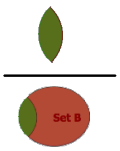
But what if the two dice were not rolled at the same time?

When the events were independent and unknown, we were dealing with this scenario.



But once we know that Event B has occurred, we are confined to that circle.

$P(A \cap B) =$ 

$P(A \mid B) =$ 

Which probability should be larger?

Example 1: What is the probability of rolling a sum greater than 7 with two dice if it is known that the first die rolled is a 3?

Let A be the event that a sum greater than 7 is rolled.
Let B be the event that the roll of the first die is a three.

Now construct a table of the potential outcomes.

	1	**2**	**3**	**4**	**5**	**6**
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

The outcomes that concern us are highlighted in red. Note that while there are 6 outcomes for event B, there are only 2 outcomes (8, 9) that satisfy both.

From the table, $n(AB) = 2$ and $n(S) = 36$, so

$$P(A \cap B) = \frac{2}{36} = \frac{1}{18} \quad \text{and} \quad P(B) = \frac{1}{6}$$

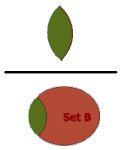
Hence,

$$P(A \mid B) = \frac{P(A \cap B)}{P(B)}$$

$$= \frac{\frac{1}{18}}{\frac{1}{6}}$$

$$= \frac{1}{18} \times \frac{6}{1}$$

$$= \frac{1}{3}$$



The probability of rolling a sum greater than 7, given that the first roll is 3, is equal to 1/3.

To confirm our findings by visual inspection, we see that if we roll a 3 first, there are only two ways in which we can then have a sum greater than 7. Thus, our probability would be 2/6, which reduces to 1/3.

1. The finance department of your firm has been asked to provide financial projections for next year. Economists are predicting a 30% chance of a recession. Historically, 20% of the years of profit for your firm occur during economic recessions.

Given that there is a recession, what is the probability of your firm making a profit?

2. A math teacher gave her class two tests. 25% of the class passed both tests and 42% of the class passed the first test. What percent of those who passed the first test also passed the second test? Illustrate with a Venn Diagram.

3. A consultant's study found that Boulton's call centre had a 5% chance of transferring a call about schedules to the lost articles department by mistake. The same study shows that 1% of the time customers calling for schedules have to wait on hold only to discover that they have been transferred to the lost articles department. What are the chances that a customer transferred to lost articles will be put on hold. Illustrate with a Venn Diagram.

4. Gallant's computer sometimes crashes when he tries to use his email program Firstclass. When Firstclass hangs, Gallant is usually able to close Firstclass without a system crash (since he uses a Mac). In a computer magazine, he reads that the probability of Firstclass hanging in any 15 minute period, is 2.5%. While the chance of Firstclass and the operating system failing together in any 15 minute period is 1%. If Firstclass is hanging, what is the probability that the operating system will crash. Illustrate with a Venn Diagram.

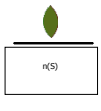
For extra practice, check out:

http://www.algebralab.org/lessons/lesson.aspx?file=Algebra_ConditionalProbability.xml

A Summary of Probability

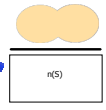
Independent

And



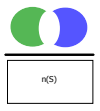
by %
$P(A \cap B) = P(A) \times P(B)$
by #s or surface area
$P(A \cap B) = \frac{n(A \cap B)}{n(S)}$

Or



by %
$P(A \cup B) = P(A) + P(B) - P(A \cap B)$
by #s or surface area
$P(A \cup B) = \frac{n(A) + n(B) - n(A \cap B)}{n(S)}$

Xor



by %
$P(A \text{ Xor } B) = P(A) + P(B) - 2P(A \cap B)$
by #s or surface area
$P(A \text{ Xor } B) = \frac{n(A) + n(B) - 2n(A \cap B)}{n(S)}$

Dependent

Note how it's NOT over the whole n(S)

by %
$P(A \mid B) = \frac{P(A \cap B)}{P(B)}$
by #s or surface area
$P(A \mid B) = \frac{n(A \cap B)}{n(B)}$

Answer Clues

1. ~66.7%
2. 59.5%
3. 20%
4. 40%