CONDITIONAL PROBABILITIES

Example US Senate

	R	D	
Y	32	20	52
N	26	22	48
	58	42	100

Questions

When a Senator is chosen at random

1) what is the probability that the Senator is Republican?

$$P(R) = \frac{58}{100}$$

2) What is the probability that the Senator is a Democrat?

$$P(D) = \frac{42}{100}$$

3) What is the probability that the Senator voted Y? N?

$$P(Y) = \frac{52}{100} \qquad P(N) = \frac{48}{100}$$

4) What is the probability that the Senator voted Y and the Senator is a R?

$$P(Y \cap R) = \frac{32}{100}$$

5) What is the probability that the Senator voted Y knowing (or given) that the Senator is a Republican?

6) What is the probability that a Republican Senator, votes Yes?

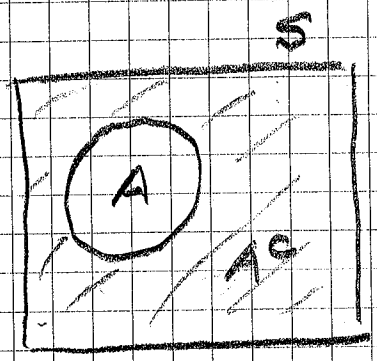
$$P(Y \mid R) = \frac{32}{58}$$

$$P(Y \mid R) = \frac{P(Y \cap R)}{P(R)} = \frac{32/100}{58/100} = \frac{32}{100} \cdot \frac{100}{58} = \frac{32}{58}$$

The Complement Rule

$$P(A) = 1 - P(A^c)$$

$$P(A^c) = 1 - P(A)$$



Example throwing two dice

A: outcomes whose sum is 6

A^c: " " " " not 6

1st \ 2nd	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

$$P(\text{Sum Not 6}) = \frac{31}{36}$$

$$P(\text{Sum Not 6}) = 1 - P(\text{Sum is 6}) = 1 - \frac{5}{36} = \frac{36-5}{36} = \frac{31}{36}$$