# Lectures 9 and 10

Random variables such as role of a dice.
Probability distributions
Problem if uniform distribution for a countably infinite set
$a + a + a^2 + \ldots + a^n = \frac{1-a^n}{1-a}$
Joint probability $\text{Prob}(A, B)$
Conditional probability $\text{Prob}(A|B)$.
$\text{Prob}(A|B) = \frac{\text{Prob}(A \cap B)}{\text{Prob}(B)}$
Independence
If events $A$ and $B$ are independent

$$Prob(A \cap B) = \text{Prob}(A)\text{Prob}(B)$$

Bayes rule

$$\text{Prob}(B|A) = \frac{\text{Prob}(A|B)\text{Prob}(B)}{\text{Prob}(A)}$$

Expectation of a random variable $\sum_x xp(x)$
Linearity of expectation $E(x + y) = E(x) + E(y)$
Variance $\sigma(x) = E(x - E(x))^2$
$\sigma(x) = E(x^2) - E(x)^2$
$\text{Var}(x + y) = \text{Var}(x) + \text{Var}(y) + 2E(xy)$
If $x$ and $y$ are independent $E(xy) = E(x)E(y)$ and $\sigma^2(x + y) = \sigma^2(x) + \sigma^2(y)$
Standard deviation is square root of variance.