

Useful Formulas and Definitions

1. Conditional Probability

$$P[A|B] = \frac{P[AB]}{P[B]}$$

2. Bayes' Theorem

$$P[B|A] = \frac{P[A|B]P[B]}{P[A]}$$

3. Independence

$$P[AB] = P[A]P[B]$$

4. "n choose k"

$$\binom{n}{k} = \frac{n!}{k!(n-k)!}$$

5. CDF

$$F_X(x) = P[X \leq x]$$

6. Bernoulli (p) random variable PMF:

$$P_X(x) = \begin{cases} 1-p & x=0 \\ p & x=1 \\ 0 & \text{otherwise.} \end{cases}$$

7. Binomial (n, p) random variable PMF:

$$P_X(x) = \begin{cases} \binom{n}{x} p^x (1-p)^{n-x} & x=1, 2, \dots, n \\ 0 & \text{otherwise.} \end{cases}$$

8. Geometric (p) random variable PMF:

$$P_X(x) = \begin{cases} p(1-p)^{x-1} & x=1, 2, \dots \\ 0 & \text{otherwise.} \end{cases}$$

9. Stirling's approximation, for large n :

$$n! \approx \sqrt{2\pi n} \left(\frac{n}{e}\right)^n$$

10. Arithmetic series

$$\sum_{i=1}^n i = \frac{n(n+1)}{2}$$

11. Geometric series

$$\sum_{i=0}^{n-1} r^i = \frac{1-r^n}{1-r}$$

12. Taylor expansion of e^x

$$e^x = \sum_{i=0}^{\infty} \frac{x^i}{i!}$$