Math 151 – Probability
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Distributions

Random Variables & Distributions

- **random variable** Let S be the sample space for an experiment. A real-valued function that is defined on S is called a random variable.

- **distribution** Let X be a random variable. The distribution of X is the collection of all probabilities of the form $P(X \in C)$ for all sets C of real numbers such that $\{X \in C\}$ is an event.

- **discrete** A random variable X is discrete if it can take only a finite number k of different values, $x_1, x_2, \ldots, x_k$ or, at most, an infinite sequence of different values $x_1, x_2, \ldots$.

- **probability function** If a random variable X has a discrete distribution, the probability function of X is defined as the function f such that for every real number x,

$$f(x) = P(X = x)$$

- **Bernoulli** A random variable Z that takes only two values 0 and 1 with $P(Z = 1) = p$ has a Bernoulli distribution with parameter p.

- **uniform** Let $a \leq b$ be integers. Suppose that the value of a random variable X is equally likely to be each of the integers $a, \ldots, b$. Then we say that X has a uniform distribution on the integers $[a, b]$.

- **binomial** A binomial random variable is a sum of Bernoulli random variables.

- **continuous** A random variable X is continuous if there exists a nonnegative function f, defined on the real line, such that for every interval of real numbers, the probability that X takes a value in the interval is the integral of f over the interval. For example:

$$P(a \leq X \leq b) = \int_a^b f(x)dx$$

- **probability density function** If X has a continuous distribution, the function f described above is called the probability density function (pdf).

- **cumulative distribution function** The cumulative distribution function (cdf) of a random variable is the function:

$$F(x) = P(X \leq x)$$