MATH/STAT 3360, Probability
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Formula Sheet

Combinatorial Analyis

- $n!$ — Number of ways to order n things.
- ${}_nP_m = n(n-1)\cdots(n+1-m)$
- $\binom{n}{m} = \frac{n(n-1)\cdots(n+1-m)}{m!}$
- $\binom{n}{n_1,n_2,\ldots,n_k} = \frac{n!}{n_1!n_2!\cdots n_k!}$ – Number of distinct ways to order n things of k distinct types with n_i of the ith type.

Axioms of Probability

- $0 \leqslant P(E) \leqslant 1$
- $P(S) = 1$.
- If $A_1, A_2, \ldots$ are mutually exclusive, then $P(A_1 \cup A_2 \cup \cdots) = \sum_{i=1}^{\infty} P(A_i)$.

Discrete Random Variables

Distribution	Parameters	$P(X = i)$	$E(X)$	$\text{Var}(X)$
Binomial	n, p	$\binom{n}{i}p^i(1-p)^{n-i}$	np	$np(1-p)$
Poisson	λ	$e^{-\lambda}\frac{\lambda^i}{i!}$	λ	λ

Continuous Random Variables

Distribution	Parameters	Probability density function	cumulative distribution function $F(x)$	$E(X)$	$\text{Var}(X)$
Uniform	a, b	$\begin{cases} \frac{1}{b-a} & \text{if } a < b < x \\ 0 & \text{otherwise} \end{cases}$	$\begin{cases} 0 & x < a \\ \frac{x-a}{b-a} & a < b < x \\ 1 & x > b \end{cases}$	$\frac{a+b}{2}$	$\frac{(b-a)^2}{12}$
Normal	μ, σ^2	$\frac{1}{\sqrt{2\pi}\sigma}e^{-\frac{(x-\mu)^2}{2\sigma^2}}$	$\Phi(x)$ (see table)	μ	σ^2
Exponential	λ	$\lambda e^{-\lambda x}$	$1 - e^{-\lambda x}$	$\frac{1}{\lambda}$	$\frac{1}{\lambda^2}$

- Hazard rate function - $\lambda(t) = \frac{f(t)}{1-F(t)}$.