38 Summary of Important Formulas

8. Bernoulli Trials and Binomial Distributions	$p(k) = \binom{n}{k} p^k (1-p)^{n-k}, \quad k = 0, 1, \ldots, n$	Binomial distribution with parameter (n, p)
9. Expectations	$E[Y] = np$	Expectation of binomial distribution
10. Expectations with Independent Random Variables	$\mathrm{Var}(X) = E[(X - E(X))^2]$ $= E[X^2] - (E[X])^2$	Variance of a random variable X
	$\mathrm{Cov}(X, Y) = E((X - \mu_x)(Y - \mu_y))$ $= E(XY) - E(X) \times E(Y)$	Covariance of X and Y with $\mu_x = E(X)$ and $\mu_y = E(Y)$
	$\mathrm{Var}(Y) = np(1-p)$	Variance of binomial distribution
12. Poisson Distributions	$p(k) = e^{-\lambda} \dfrac{\lambda^k}{k!}, \quad k = 0, 1, 2, \ldots$	Poisson distribution with parameter λ
	$E[Y] = \mathrm{Var}(Y) = \lambda$	Expectation and variance of Poisson distribution
14. Descriptive Statistics	$\bar{X} = \dfrac{1}{n} \sum_{i=1}^{n} X_i$	Sample mean
	$S^2 = \dfrac{1}{n-1} \sum_{i=1}^{n} (X_i - \bar{X})^2$	Sample variance
	$= \dfrac{1}{n-1} \left(\sum_{i=1}^{n} X_i^2 - n\bar{X}^2 \right)$	
17. Continuous Probability Distributions	$f(x) = \begin{cases} 1/(b-a) & \text{if } a \le x \le b; \\ 0 & \text{otherwise} \end{cases}$	Uniform density function on $[a, b]$
18. Expectations and Variances	$E[X] = \dfrac{a+b}{2}$; $\mathrm{Var}(X) = \dfrac{(b-a)^2}{12}$	Expectation and variance of Uniform distribution on $[a, b]$
20. Gamma Distributions	$f(x) = \begin{cases} \lambda e^{-\lambda x} & x \ge 0; \\ 0 & x < 0 \end{cases}$	Exponential density function
	$E[X] = \dfrac{1}{\lambda}$; $\mathrm{Var}(X) = \dfrac{1}{\lambda^2}$	Expectation and variance of exponential distribution
27. Confidence Interval for Mean	$\bar{X} \pm \dfrac{t_{\alpha/2, n-1} S}{\sqrt{n}}$	Confidence interval of level $(1 - \alpha)$
28. Concept of Statistical Tests	$T = \dfrac{\bar{X} - \mu_0}{S/\sqrt{n}}$	t-statistic (or test statistic)