

1 Formula Sheet for Exam 1

$$\bar{x} = \frac{\sum x_i}{n}, \quad s^2 = \frac{\sum (x_i - \bar{x})^2}{n - 1}$$

Probability rules:

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A \cap B) = P(A)P(B|A)$$

$$P(B|A) = \frac{P(A \cap B)}{P(A)}$$

$$P(A) = P(A \cap B_1) + P(A \cap B_2) + \dots + P(A \cap B_k)$$

$$P(B_i|A) = \frac{P(A|B_i)P(B_i)}{P(A|B_1)P(B_1) + \dots + P(A|B_k)P(B_k)}$$

Combination rule :

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

For a general discrete random variable :

$$\mu = E(X) = \sum xp(x)$$

$$\sigma^2 = Var(X) = \sum (x - \mu)^2 p(x)$$

For a binomial distribution:

$$P(X = x) = \binom{n}{x} p^x (1-p)^{n-x}, \quad \text{for } x = 0, 1, 2, \dots, n.$$

$$\mu = np, \quad \sigma^2 = np(1-p).$$

For a Poisson distribution:

$$P(X = x) = \frac{\lambda^x e^{-\lambda}}{x!}, \quad \text{for } x = 0, 1, \dots$$

$$\mu = \lambda, \quad \sigma^2 = \lambda.$$

For a normal random variable X with mean μ and standard deviation σ :

$$Z = \frac{X - \mu}{\sigma}.$$

Mean of a random variable, X , (the expected value, expectation) is:

$$\mu = E(X) = \begin{cases} \sum_i x_i \cdot P(X = x_i) & \text{for discrete r.v.} \\ \int_{-\infty}^{\infty} x \cdot f(x) dx & \text{for continuous r.v.} \end{cases}$$

Variance of a random variable, X , is:

$$\sigma^2 = Var(X) = E(X - \mu)^2 = E(X^2) - \mu^2$$