CHAPTER 2 PROBABILITY

Properties of Probability

- $P(A) + P(A') = 1$
- $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- $P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(A \cap C) - P(B \cap C) + P(A \cap B \cap C)$

Conditional Probability

- $P(A|B) = \frac{P(A \cap B)}{P(B)}$
- Multiplication Rule for $P(A \cap B) = P(A|B) * P(B)$

INDEPENDENCE

- $P(A \cap B) = P(A) * P(B)$

Practice Problems Numbers

2.1 1,2,3,4,6,8,9,10
2.2 12,14,15,16,18,20,22,24,26
2.3 29,30,32,34,36,38,40,42
2.4 46 48 50 52 60 61 62 66 68
2.5 71 74 76 77 78 79 80 84 88

CHAPTER 3 DISCRETE RANDOM VARIABLE 7 PROBABILITY DISTRIBUTION

PROBABILITY DISTRIBUTION FOR DISCRETE

EXPECTED VALUES

$$E(x) = \mu_x = \sum x * p(x) \tag{1}$$

Expected Values for a Linear Function

$$E(Ax + B) = aE(x) + B \tag{2}$$

VARIANCE

$$V(x) = E(x - \mu)^2 = \sum (x - \mu)^2 * p(x) \tag{3}$$

EXPECTED VALUES OF A LINEAR FUNCTION

$$V(aX + B) = a^2 V(x) \tag{4}$$

Standard Deviation

$$\sigma = \sqrt{E(x^2) - [E(x)]^2} \tag{5}$$

BINOMIAL PROBABILITY DISTRIBUTION

$$b(x;n,p) = \binom{n}{k} p^x (1-p)^{n-x} \tag{6}$$

where $x = 0, 1, 2, 3, ..., n$ otherwise it is 0.

POISSON PROBABILITY DISTRIBUTION

$$p(x;\mu) = \frac{e^{-x}\mu^x}{x!} \tag{7}$$

PRACTICE PROBLEMS

- 2 6 7 11 12 14 39 42 43 57 62 78 72 81 83

CHAPTER 4 PROBABILITY DENSITY FUNCTION

pdf

$$P(a \le X \le b) = \int_a^b f(x)dx \tag{8}$$

Uniform Distribution

a continuous rv on a single interval [a,b]

$$f(x;A,B) = \frac{1}{B-A} \tag{9}$$

Using F(x) to compute Probability

$$P(a \le x \le b) = F(b) - F(a) \tag{10}$$

X be a continuous rv with pdf f(x) and CDF F(x)

$$P(X > a) = 1 - F(a) \tag{11}$$

Expected or Mean of the continuous rv with pdf f(x)

$$\mu_x = E(x) = \int_{-\infty}^{\infty} x * f(x)dx \tag{12}$$

Variance

$$V(x) = E(x^2) - [E(x)]^2 \tag{13}$$

NORMAL DISTRIBUTION

$$f(x;\mu,\sigma) = \frac{1}{\sqrt{2\pi}\sigma} e^{\frac{-(x-\mu)^2}{2\sigma^2}} \tag{14}$$

EXPONENTIAL DISTRIBUTION

$$f(x;\lambda) = \lambda e^{-\lambda x} x \leq 0 \tag{15}$$

PRACTICE PROBLEM

- 2 11 17 43 47 28 37 61 68 84 83 78 76 31

CHAPTER 5 JOINT PROBABILITY DISTRIBUTION AND RANDOM SAMPLES

PROBABILITY IN SEVERAL VARIABLES

CHAPTER 6 POINT ESTIMATION

Point Estimate of θ

Unbiased Estimator

$E(\widehat{\theta}) = \theta$

if not the bias of $\widehat{\theta}$ is $E(\widehat{\theta}) - \theta$

X is binomial rv unbiased estimator p

$$\widehat{p} = \frac{X}{n}$$

$\widehat{\sigma^2}$

$$\widehat{\sigma^2} = \frac{\sigma(X_i - \overline{X})^2}{n-1} \tag{16}$$