SEG 2430 Applied Probability and Statistics

2010 Spring Assignment 3 Solutions

Due Feb 12, 2010

1. Solution to 4.10: (10 points)

(a). The binomial distribution calculates the probability of getting x **successes** in n **trials.** In this case, we don't know the trial number n. The test stops only when one player fails. ……. ……5

(b). The probability of presence or absence of cavity is different for each tooth, and a tooth's cavity is dependent on the teeth next to it. ……5

2. Solution to 4.11: (10 points)

(a). Trials are not independent. People having a cold will infect to others. …..……5

(b). Samples are chosen without replacement. The probability of getting a defective projector changes after one projector selected and recorded. ……..……5

3. Solution to 4.19: (30 points)

(a). Substituting x=18, n=18, and p=0.90 into the formula for binomial distribution, we get:

$$b(18;18,0.9)=\binom{18}{18}(0.9)^{18}(0.1)^{0}=0.1501$$ ……10

(b). Substituting n=18, and p=0.90 into the formula for binomial distribution, we get:

$$\sum_{x=16}^{18} b(x;18,0.9)=1-B(15;18,0.9)=0.7338$$ ……10

(c). Substituting n=18, and p=0.90 into the formula for binomial distribution, we get:

$$\sum_{x=0}^{14} b(x;18,0.9)=B(14;18,0.9)=0.0982$$ ……10

4. Solution to 4.23: (10 points)

Substituting x=2, n=6, a=8 and N=18 into the formula for hypergeometric distribution, we get

$$\mathrm{h}(2;6,8,18)=\frac{\binom{8}{2}\binom{10}{4}}{\binom{18}{6}}=0.3167$$ ……10

5. Solution to 4.34: (20 points)

(a). The mean of this probability distribution:

$$\mu=0\times0.17+1\times0.29+2\times0.27+3\times0.16+4\times0.07+5\times0.03+6\times0.01=1.80$$ ….10

(b). The variance of this probability distribution:

$$\sigma^2=(0-1.80)^2\times0.17+(1-1.80)^2\times0.29+(2-1.80)^2\times0.27+(3-1.80)^2\times0.16$$
$$+(4-1.80)^2\times0.07+(5-1.80)^2\times0.03+(6-1.80)^2\times0.01=1.80$$

The standard deviation of this probability distribution:

$$\sigma=\sqrt{1.80}=1.34$$ ……10

6. Solution to 4.46: (20 points)

$$\mu = 405 \times \frac{1}{6} = \frac{135}{2}$$

$$\sigma = \sqrt{405 \times \frac{1}{6} \times \frac{5}{6}} = \frac{45}{6} = \frac{15}{2}$$ ……..……..……..… 10

For $X < 30 \ or \ X > 105$, $X < \mu - k\sigma \ or \ X > \mu + k\sigma$

yields $k = 5$ for the Chebyshev's Theorem, ……......10

$$\therefore P(X < 30 \ or \ X > 105) \le \frac{1}{k^2} = \frac{1}{25}$$

MARKS ARE HEAVILY DEDUCTED FOR ANSWERS WITHOUT STEPS OR EXPLAINATIONS.