ISE 2211 Statistics for Engineers

Homework #3 - Chapter 3 (Montgomery & Runger, 5ed)

Chapter 3 Discrete Random Variables and Probability Distributions

Problems:

Answers to odd-numbered problems can be found in Appendix B.
Answers to even-numbered problems are provided below.

3-4 Mean and Variance of Discrete Random Variable
Page 75, Example 3-10
Page 76, Example 3-11
Page 76, Problems 3-49, 51, 55

3-5 Discrete Uniform Distribution
Page 79, Problems 3-65, 67, 71

3-6 Binomial Distribution
Pages 84, Problems 3-77, 79, 85, 86, 87

3-9 Poisson Distribution
Pages 101 - 103, Problems 3-129, 132, 137, 139, 140

3-86. Let X denote the number of questions answered correctly. Then, X is binomial with n = 25 and p = 0.25.

a) $P(X \geq 20) = \binom{25}{20} 0.25^{20}(0.75)^5 + \binom{25}{21} 0.25^{21}(0.75)^4 + \binom{25}{22} 0.25^{22}(0.75)^3 + \binom{25}{23} 0.25^{23}(0.75)^2 + \binom{25}{24} 0.25^{24}(0.75)^1 + \binom{25}{25} 0.25^{25}(0.75)^0 = 9.677 \times 10^{-10}$

b) $P(X < 5) = \binom{25}{0} 0.25^0(0.75)^{25} + \binom{25}{1} 0.25^1(0.75)^{24} + \binom{25}{2} 0.25^2(0.75)^{23} + \binom{25}{3} 0.25^3(0.75)^{22} + \binom{25}{4} 0.25^4(0.75)^{21} = 0.2137$

3-132. Let X denote the number of calls in one hour. Then, X is a Poisson random variable with $\lambda = 10$.

a) $P(X = 5) = \dfrac{e^{-10}10^5}{5!} = 0.0378$

b) $P(X \leq 3) = e^{-10} + \dfrac{e^{-10}10}{1!} + \dfrac{e^{-10}10^2}{2!} + \dfrac{e^{-10}10^3}{3!} = 0.0103$

c) Let Y denote the number of calls in two hours. Then, Y is a Poisson random variable with $\lambda = 20$.

$P(Y = 15) = \dfrac{e^{-20}20^{15}}{15!} = 0.0516$

d) Let W denote the number of calls in 30 minutes. Then W is a Poisson random variable with $\lambda = 5$.

$P(W = 5) = \dfrac{e^{-5}5^5}{5!} = 0.1755$

3-140. a) Let X denote the failures in 8 hours. Then, X has a Poisson distribution with $\lambda = 0.16$.

b) Let Y denote the number of failure in 24 hours. Then, Y has a Poisson distribution with $\lambda = 0.48$.