**ChE 320\_Spr\_17\_HW 3 Solution**

**3-100**

# a) P(X < 0.25) = P(X=0.1) + P(X=0.2) + = 0.1 + 0.1 = 0.2

b) P(0.15 < X ≤ 4.5) = 0.9

c) F(x)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | x < 0.1 | 0.1 ≤ x < 0.2 | 0.2 ≤ x < 0.3 | 0.3 ≤ x < 0.4 | 0.4 ≤ x < 0.5 | 0.5 ≤ x < 0.6 | 0.6 ≤ x |
| F(x) | 0 | 0.1 | 0.2 | 0.5 | 0.7 | 0.9 | 1.0 |

d) E(X) = 0.1(0.1) + 0.2(0.1) + 0.3(0.3) + 0.4(0.2) + 0.5(0.2) + 0.6(0.1) = 0.36

**3-101**

A binomial distribution is based on a fixed number of independent trials with two outcomes and a constant probability of success on each trial.

a) reasonable.

b) independence assumption not reasonable.

c) The probability that the second component fails depends on the failure time of the first

component. The binomial distribution is not reasonable.

d) not independent trials with constant probability.

e) probability of a correct answer not constant.

f) reasonable.

g) probability of finding a hole on the chip is not constant.

1. If the fills are independent with a constant probability of an underfill, then the binomial distribution for the number packages underfilled is reasonable.

i) Because of the bursts, each trial (that consists of sending a bit) is not independent.

j) not independent trials with constant probability

**3-104**

a) The probability mass function is



b) The cumulative distribution function is

c) The value of X that appears to be most likely is 0.

d) The value of X that appears to be least likely is 10, although the probabilities for values of x greater than

1 are very small.

**3-130**

a) Let X denote the number of flaws in 25 square yards. Then, X is a Poisson random variable with λ = 25(0.01) = 0.25. P(X = 0) = e-0.25 = 0.7788.

b) Let Y denote the number of flaws in one square yard, then P(Y = 0) = e-0.01 = 0.99

c) P(Y = 0) = 0.99. Let V denote the number of square yards out of 10 that contain no flaws. Then, V is a binomial random variable with n = 10 and p = 0.99.

P(V ≥ 8) = P(V = 8) + P(V = 9) + P(V = 10) = 0.9999

**3-142**

Let X denote the number of calls in 30 minutes. Because the time between calls is an exponential random variable, X is a Poissonrandom variable with  calls per minute ⇒ 3 calls per 30 minutes.

a) P(X > 3) = 

b) P(X = 0) = 

c) Let Y denote the time between calls in minutes. Then,  and

.

Therefore,  and x = 46.05 minutes.

d) 

e) The probability of no calls in one-half hour is (from part b) e-3 = 0.04979. Therefore, for four non-overlapping one-half hour intervals, the probability of no calls is (e-3)4 = (0.04979)4 = 6.14 × 10-6.

**3-160**

a) P(X ≤ 5, Y ≤ 8) = P(X ≤ 5)P(Y ≤ 8)

= (0.6321)(0.6321)

= 0.3996

b) P(X > 5, Y ≤ 6) = P(X > 5)P(Y ≤ 6)

= (1 − P(X ≤ 5))P(Y ≤ 6)

= (0.3679)(0.5276)

= 0.1941

c) P(3 < X ≤ 7, Y > 7) = P(3 < X ≤ 7)P(Y > 7)

= (P(Y ≤ 7) − P(Y ≤ 3))(1 − P(Y ≤ 7))

= (0.3022)(0.4169)

= 0.1260

d) P(X > 7, 5 < Y ≤ 7) = P(X > 7)P(5 < Y ≤ 7)

= (1 − P(X ≤ 7))(P(Y ≤ 7) − P(Y ≤ 5))

= (0.2466)(0.1184)

= 0.0292

**3-170**

P(operate) = [1-(0.1)(0.05)]2 = 0.990025

**3-174**

a) E(Y) = E(2X1 + 1X2 – 3X3) = 2(4) + 1(3) – 3(2) = 5

b) V(Y) = V(2X1 + 1X2 – 3X3) = 4(1) + 1(5) + 9(2) = 27

**3-180**

Let D denote the width of the casing minus the width of the door. Then, D is normally distributed.

1. E(D) = 1/8

V(D) = ,

b) 

c) 

**3-100**

E(Y) ≅ (100)2 +2(100) + 1 = 10201, V(Y) ≅ [2(100) + 2]2(25) = 1020100