Exercises

Chapter 5 - Several Useful Discrete Distributions

1) In a survey, 62% of adults said they do not know what WWW is. Nine adults are selected at random.

1.1) Find the probability that exactly three adults will say they know what WWW is.
1.2) Find the probability that at least eight adults will say they don't know what WWW is.
1.3) On the average how many adults do not know what WWW is?

2) Of thirteen adults there are eight of them who do not know what WWW is. If a sample of nine adults is randomly taken, what is the probability that there are exactly five adults who do not know what WWW is?

3) The Post Office has established a record in a major Midwestern city for delivering 90% of its local mail the next working day. If you mail eight local letters,

a) find the probability that all of them will be delivered the next day,
b) find the probability that exactly six letters will be delivered the next day,
c) find the probability that less than three letters will be delivered the next day,
d) calculate the average number you expect to be delivered the next day,
e) calculate the standard deviation of the number delivered.
find the probability that the number of delivered will be within 2 standard deviations of the mean.

4) Let $n = 15$ and $p = 0.3$. Use the binomial table, (TABLE 1) to find

a) $p(5)$
b) $P(x \le 8)$
c) $P(x < 8)$
d) $P(x \ge 7)$
e) $P(5 \le x \le 7)$
f) $P(5 < x \le 7)$

5) The number x of people entering the intensive care unit at a particular hospital on any one day has a Poisson probability distribution with mean equal to five persons per day.

a) Find the probability distribution of x.
b) Is it likely that x will exceed 10? Explain.
c) What is the probability that the number of people entering the intensive care unit on a particular day is two? Less than or equal to two?
d) What is the probability that there are seven persons entering the intensive care unit on any two days?

6) Let x be a Poisson random variable with mean $\mu = 4.5$. Use Table 2 in Appendix I to find these probabilities.

a) $P(x < 4)$

b) $P(x = 5)$

c) $P(x \geq 3)$

d) $P(x > 3)$

e) $P(2 \leq x \leq 6)$

f) $P(2 < x < 6)$

7) Telephone calls entering a college campus follow a Poisson probability distribution with mean equal to three per minute.

a) Find the probability of four calls arriving in any minute.

b) Find the probability that there is no call in a minute from now.

c) Find the probability distribution of x, where x is the number of calls in any given minute.

d) Find the probability that there are twelve calls in 10 minutes.

8) Ten microprocessor chips are in stock. Four have etching errors that cannot be detected by the naked eyes. Three chips are selected and installed in field equipment.

a) Find the probability that no chips with etching errors will be selected.

b) Find the probability distribution of x, the number of chips selected that have etching errors.

c) Find the mean of x.

9) There are three bananas and seven oranges in the refrigerator. Five fruits are chosen at random to serve guest, and let x be the number of fruits that are oranges.

a) Find the probability distribution of x.

b) Find the mean of x.

c) What is the probability that of five fruits chosen two of them are bananas?

Answers

Chapter 5 - Several Useful Discrete Distributions

1.1) $C_3^9(0.38)^3(0.62)^6$

1.2) $\sum_{k=8}^{9} C_k^9(0.62)^k(0.38)^{9-k}$

1.3) 5.58

2) 0.3916

3) a) P(x=8) =0.4305 b) 0.1488 c) ≈ 0 d) 7.2

e) $\sqrt{npq} = \sqrt{(7.2)(.1)} = \sqrt{.72} = 0.85$

The number of delivered will be within 2 standard deviations of the mean is 7.2 ± 2(.85) = 7.2 ± 1.7). So,

P(5.5 ≤ x ≤ 8) = (6 ≤ x ≤ 8) = (.4305) + (.3826) + (.1488) = 0.9619

4) a) 0.7216-0.5155 = 0.2061 b) 0.9848 c) 0.9502

d) $P(x \geq 7) = 1 - P(x \leq 6) = 1 - 0.8689 = 0.1311$

e) $P(5 \leq x \leq 7) = 0.950 - 0.5155 = 0.4345$

f) $P(5 < x \leq 7) = 0.950 - 0.7216 = 0.2284$

5) a) $P(x = k) = \dfrac{e^{-5}5^k}{k!}$ for $k = 0, 1, 2, 3, \ldots$

b) You have to compute the z-score, then justify your answer.

c) $P(x = 2) = \dfrac{e^{-5}5^2}{2!}$, $P(x \leq 2) = \sum_{x=0}^{2} \dfrac{e^{-5}5^x}{x!} = 0.1247$

d) $P(y = 7) = \dfrac{e^{-10}10^7}{7!}$

6) a) 0.3423

b) 0.7029-0.5321 = 0.1708

c) $P(x \geq 3) = 1 - P(x \leq 2) = 0.8264$

d) $P(x > 3) = 1 - P(x \leq 3) = 1 - 0.3423 = 0.6577$

e) $0.8311 - 0.0611 = 0.77$

f) $P(x \leq 5) - P(x \leq 2) = 0.7029 - 0.1736 = 0.5293$

7) a) μ = 3 calls per min, $P(x = 4) = \dfrac{e^{-3}3^4}{4!}$ or

$P(x \leq 4) - P(x \leq 3) = 0.815 - 0.647 = 0.1681$

b) $P(x=0)=\dfrac{e^{-3}3^{0}}{0!}$ or 0.055

c) $P(x=k)=\dfrac{e^{-3}3^{k}}{k!}$ for $k = 0, 1, 2, 3, \ldots$

d) $P(x=12)=\dfrac{e^{-30}30^{12}}{12!}$

8) a) $P(x=0)=\dfrac{C_0^4 C_3^6}{C_3^{10}}=\dfrac{20}{120}=\dfrac{1}{6}$

b) $P(x=k)=\dfrac{C_k^4 C_{3-k}^6}{C_3^{10}}$ for $k = 0, 1, 2, 3$

c) $3\left(\dfrac{4}{10}\right)=1.2$ chips with errors.

9) a) $P(x=k)=\dfrac{C_k^7 C_{5-k}^3}{C_5^{10}}$ for $k = 2, 3, 4, 5$

b) 3.5 oranges

c) 0.4137