Ch06 Study Guide
Binomial Distribution

Example 1

It is known that 12% of the calculators shipped from a particular factory are defective. $n=6$ $p=0.12$ $1-p=0.88$

a. What is the probability that exactly three of six chosen calculators are defective?

$${}_6C_3(0.12)^3(0.88)^3 = 0.0236$$

b. What is the probability that none in a random sample of six calculators is defective?

$${}_6C_0(0.12)^0(0.88)^6 = 0.4644$$

c. What is the probability that at least one in a random sample of six calculators is defective?

$A = 1,2,3,4,5,$ or 6 $\quad P(A) = 1 - P(A')$

$A' = 0$ $\quad = 1 - 0.4644$

$= 0.5356$

Example 2

Twenty-five percent of the CFA candidates have a degree in economics. A random sample of four CFA candidates is selected. $n=4$ $p=0.25$ $1-p=0.75$

a. What is the probability that none of them has a degree in economics?

$${}_4C_0(0.25)^0(0.75)^4 = 0.3164$$

b. What is the probability that at least one of them has a degree in economics?

$A = 1,2,3,$ or 4 $\quad P(A) = 1 - P(A') = 1 - 0.3164 = 0.6836$

Example 3

On a particular production line, the likelihood that a light bulb is defective is 8%. Fifteen light bulbs are randomly selected. $n=15$ $p=0.08$ $1-p=0.92$

a. What is the probability that two light bulbs will be defective?

$${}_{15}C_2(0.08)^2(0.92)^{13} = 0.2293$$

b. What is the probability that none of the light bulbs will be defective?

$${}_{15}C_0(0.08)^0(0.92)^{15} = 0.2863$$

c. What are the mean and variance of the number of defective bulbs?

$E(x) = np = (15)(0.08) = 1.2$

$V(x) = np(1-p) = (15)(0.08)(0.92) = 1.104$

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Example 4

For a particular clothing store, a marketing firm finds that 22% of $10-off coupons delivered by mail are redeemed. Suppose ten customers are randomly selected and are mailed $10-off coupons. $n = 10 \quad p = 0.22$

a. What is the probability that three of the customers redeem the coupon?

$10C3\,(0.22)^3(0.78)^7 = 0.2244$

b. What is the probability that no more than one of the customers redeems the coupon?

0 or 1

$10C0\,(0.22)^0(0.78)^{10} + 10C1\,(0.22)^1(0.78)^9 = 0.3185$

$0.0834 + 0.2351$

c. What is the probability that at least two of the customers redeem the coupon?

2, 3, 4, ..., 10 (not 0 or 1)

$1 - 0.3185 = 0.6815$

d. What is the expected number of coupons that will be redeemed?

$E(x) = np = (10)(0.22) = 2.2$

Example 5

According to a Department of Labor report, the city of Detroit had a 18% unemployment rate in May of 2011. Five working-age residents were chosen at random.

$n = 5 \quad p = 0.18 \quad 1 - p = 0.82$

a. What is the probability that exactly one of the residents was unemployed?

$5C1\,(0.18)^1(0.82)^4 = 0.4069$

b. What is the probability that at least two of the residents were unemployed?

2, 3, 4, or 5 (not 0 or 1)

$1 - 5C0\,(0.18)^0(0.82)^5 + 0.4069 = 1 - 0.7776 = 0.2224$

c. What is the probability that exactly four residents were unemployed?

$5C4\,(0.18)^4(0.82)^1 = 0.0043$

d. What was the expected number of unemployed residents when five working-age residents were randomly selected?

$E(x) = np = (5)(0.18) = 0.9$

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Example 6

Chauncey Billups, a current shooting guard for the Los Angeles Clippers, has a career free-throw percentage of 89.4%. Suppose he shoots four free throws in tonight's game.

$n=4 \quad p=0.894 \quad 1-p=0.106$

a. What is the probability that Billups makes all four free throws?

$4C_4 (0.894)^4 (0.106)^0 = 0.6388$

b. What is the probability that Billups makes three or more of his free throws?

3 or 4

$4C_3 (0.894)^3 (0.106)^1 + 0.6388 = 0.9417$

c. What is the expected number of free throws that Billups will make?

$E(x) = np = (4)(0.894) = 3.576$

d. What is the standard deviation of the number of free throws that Billups will make?

$SD(x) = \sqrt{np(1-p)} = \sqrt{4(0.894)(0.106)} = 0.6157$

Answers

1. 0.0236, 0.4644, 0.5356
2. 0.3164, 0.6836
3. 0.2273, 0.2863, 1.2, 1.104
4. 0.2244, 0.3185, 0.6815, 2.2
5. 0.4069, 0.2224, 0.0043, 0.9
6. 0.6388, 0.9417, 3.576, 0.6157