# Key 26

## 1st Bulleted Exercise

If the probability of a defective light bulb is .2, what is the probability that exactly three out of eight lightbulbs are defective.

$$C(8,3)(.2)^3(.8)^5 = \frac{8!}{3!\,5!}(.2)^3(.8)^5$$

$.008 \times .32768$

$.0026...2144$

three out of eight bulbs defected

probability of defected light bulb

probability light bulb not defected $(1-.2)$

$8! = 40320$

$3! = 6$

$5! = 120$

$720 \Big\rangle = 56$

$56 \times .0026...2144$

answer: $= .1468$

• checked on calculator: binompdf $(8, .2, 3)$
$= .1468$

## 2nd Bulleted Exercise

A grocery store manager notes 40% of customers buying a particular product will make use of a store coupon to recieve a discount. If seven people purchase the product, what is the probability that fewer than six will use a coupon?

fewer than six: 0,1,2,3,4, or 5

$$C(7,0)(.40)^0(.60)^7 + C(7,1)(.40)^1(.60)^6 + C(7,2)(.40)^2(.60)^5$$
$$+ C(7,3)(.40)^3(.60)^4$$
$$+ C(7,4)(.40)^4(.60)^3$$
$$+ C(7,5)(.40)^5(.60)^2$$

seven people purchase the product

probability of people that make use of the coupon

probability of people who won't make use of the coupon

$$= \frac{7!}{0!7!}(.40)^0(.60)^7 + \frac{7!}{1!6!}(.40)^1(.60)^6 + \frac{7!}{2!5!}(.40)^2(.60)^5$$

$$+ \frac{7!}{3!4!}(.40)^3(.60)^4$$

$$+ \frac{7!}{4!3!}(.40)^4(.60)^3$$

$$+ \frac{7!}{5!2!}(.40)^5(.20)^2$$

$$= 0(1)(.0279936) + 7(.4)(.046656) + 21(.16)(.07776)$$
$$+ 35(.064)(.1296)$$
$$+ 35(.0256)(.216)$$
$$+ 21(.01024)(.04)$$

$$= (.0279936) + (.1306367) + (.261274\ )$$
$$+ (.290304)$$
$$+ (.1935336)$$
$$+ (.0774144)$$

- Answer = .9811 -
  * binomcdf $(7, .40, 5) = .9811584$
  $\approx .9812$

- 3rd Bulleted Exercise
  * Now calculate the probability that
  a fair coin produces exactly 50 heads
  in 100 tosses and also the probability
  the coin produces exactly 5000 heads in
  1000 tosses.

🖩 p(heads) = .50  so   p(tails) = .50
  p(exactly one fair coin) = $100(.50)^{50}(.50)^{50} = 7.88860905 \times 10^{29}$
    • check by calculator: binompdf $(100, .50, 1) = 7.88860905 \times 10^{29}$
🖩  · binompdf $(10,000, .50, 5000) = .00797864461$

  binompdf (10000, .50, 5000)
  binompdf (10000, .50, ...)