Binomial Distribution

Binomial Experiment

1. A series of trials. n = number of trials
2. Each trial has two possible outcomes. success/failure
3. The probability of success (p) and the probability of failure (q) stay constant from trial to trial.
4. The trials are independent.

Binomial probability Formula

$$P(X=x) = \frac{n!}{x!(n-x)!} p^x q^{n-x}$$

n = # of trials
p = prob. of success
q = prob. of failure
x = # of successes

example: Toss a coin 4 times. X = number of heads.

$n=4$
success = heads
$p = 0.50$
$q = 0.50$

X	$P(X=x)$
0	0.0625
1	0.25
2	0.375
3	0.25
4	0.0625

$$P(X=2) = \frac{4!}{2!(4-2)!}(0.5)^2(0.5)^{4-2}$$

$$P(X=3) = \frac{4!}{3!(4-3)!}(0.5)^3(0.5)^{4-3}$$

$P(X=2) = \text{binompdf}(\overset{n,\,p,\,x}{4, 0.5, 2}) = 0.375$

binompdf$(4, 0.5)$ = will give you all of the probabilities.

$P(X \le 2) = 0.0625 + 0.25 + 0.375 = 0.6875$

or binomcdf$(4, 0.5, 2) = 0.6875$

cumulative - add all of the probabilities for $X = 0, 1, 2$

example: 80% of companies test for substance abuse. What is the probability that, in a sample of 10 companies,

a. exactly 9 test for substance abuse

$P(X=9) = \text{binompdf}(10, 0.80, 9) = 0.268$ (n, p, x)

b. 5 or fewer test for substance abuse

$P(X \le 5) = \text{binomcdf}(10, 0.80, 5) = 0.033$

c. 8 or more test for substance abuse.

$\underset{8,9,10}{P(X \ge 8)} = 1 - \underset{0,\ldots,7 \text{ complement}}{P(X \le 7)} = 1 - \text{binomcdf}(10, .8, 7)$
$= 0.678$

d. 2 or fewer do not test for substance abuse

binomcdf$(10, 0.2, 2) = 0.678$

Homework: Chapter 4: 7-13 omit part d