Homework #4 – Binomial Distribution (Day 1)

Example: Computer chips have a 25% chance of being defective. Create the probability distribution for X, if X is the # of defective chips in a sample of 3. $p = .25$ $n = 3$ $(1-p) = .75$

X	0	1	2	3
P(X)	.4219	.4219	.1406	.0156

$D^c D^c D^c$ $D \cdot D^c D^c / D^c D D^c / D^c D^c D$

$1 \cdot (.25)^0 (.75)^3$ $3(.25)^1(.75)^2$ $3(.25)^2(.75)^1$ $1 \cdot (.25)^3 (.75)^0$

(a) Check if the problem is binomial

B: S = Defect
F = No Defect

I: Each chip is indep of the other

N: n = 3

S: P(S) = 0.25

(b) What is the probability of having exactly 2 defective chips?

$P(x=2) = .1406$

(c) What is the probability of having 2 or more defective chips? SAME AS

$P(x \geq 2) = .1562$ $P(x=2) + P(x=3)$

(d) What is the probability of having more than 2 defective chips? SAME AS

$P(x > 2) = .0156$ $P(x=3)$

(e) What is the probability of having 1 or less defective chips?

SAME AS

$P(x \leq 1) = .8438$ $P(x=0) + P(x=1)$

(f) What is the probability of having less than 1 defective chips?

SAME AS

$P(x < 1) = .4219$ $P(x=0)$

Example: I am playing a game in which I have a 39% chance of winning each time I play. Create the probability distribution for the number of wins out of 5 plays of the game.

$p = .39$ SUCCESS $(1-p) = .61$ FAILURE

STEP 1: Check if the problem is binomial

B: N:

I: S:

2ND VARS A: BINOMPDF

STEP 2: Create the probability distribution

X	P(X)
$P(X=0)$ 0	${}_5C_0(.39)^0 \cdot (.61)^5 = .08$
$P(X=1)$ 1	${}_5C_1(.39)^1 \cdot (.61)^4 = .27$
2	${}_5C_2(.39)^2(.61)^3 = .345$
3	${}_5C_3(.39)^3(.61)^2 = .22$
4	${}_5C_4(.39)^4 \cdot (.61)^1 = .07$
5	${}_5C_5(.39)^5 \cdot (.61)^0 = .009$

binoPDF(5, .39, __)
n p k

STEP 3: answer questions

P(X = 2) = **P(X < 2) =** **P(X ≥ 3) =** **P(2 ≤ X ≤ 4) =**

Now let's look at changing the sample size to **10**, and answering similar questions:

X	P(X)
0	.007
1	.045
2	.1312
3	.2237
4	.2503
5	.1920
6	.1023
7	.0374
8	.0089
9	.0013
10	.0000814

P(X=9) = .0013

P(X<4) = .4069

P(X≥6) = .1499

P(5≤X≤7) = .3317

$\mu = n \cdot p = 10(.39) = 3.9$

If we played many games, the expected # of wins out of 10 games is 3.9

Would you want to answer these questions for a sample size of 50? Of 100? NO! **So we can use the calculator!**

To be continued.... ☺

$\sigma = \sqrt{np(1-p)} = \sqrt{10(.39)(.61)} \approx 1.54$

On average the # of wins varies by 1.54 games from the mean of 3.9