Binomial and Geometric Probability

Binomial Properties	Geometric Properties
1. Fixed number of trials, *n*. 2. Only two mutually exclusive outcomes. 3. Independent trials. 4. Probability of success is constant *p* for each trial.	1. Only two mutually exclusive outcomes. 2. Independent trials. 3. Probability of success is constant *p* for each trial.
X is binomial random variable. $P(X=k) = {}_n C_k (p)^k (1-p)^{n-k}$ where *k* is the number of successes (or failures) Remember that ${}_nC_k = \frac{n!}{k!(n-k)!}$	X is geometric random variable. $P(X=a) = p(1-p)^{a-1}$ where *a* is the number of attempts to a success
Mean (Expected Value) $E(X) = \mu_x = np$ **Variance** $\sigma_x^2 = Var(X) = np(1-p)$ **Standard Deviation** $\sigma_x = \sqrt{np(1-p)}$	**Mean (Expected Value)** $E(X) = \mu_x = \frac{1}{p}$ **Variance** $\sigma_x^2 = Var(X) = \frac{1-p}{p^2}$ **Standard Deviation** $\sigma_x = \frac{\sqrt{1-p}}{p}$
Calculator Functions P(*X* = *k*) ➔binompdf (*n*, *p*, *k*) P($X \le k$) ➔binomcdf (*n*, *p*, *k*)	Calculator Functions P(*X* = *a*) ➔geometpdf (*p*, *a*) For cumulative events: P($X \le a$) ➔ geometcdf (*p*, *a*)
Example: Assume 40% of the market prefers Pepsi. What is the probability that 5 out of 10 randomly selected cola drinkers would choice Pepsi in a blind taste test?	Example: Assume 40% of the market prefers Pepsi. What is the probability that the first cola drinker to randomly select Pepsi in a blind taste test would be the fifth customer?

```
binomPdf(10,.4,5
)
      .2006581248
```

```
geometPdf(.4,5)
           .05184
```

Example: Assume 40% of the market prefers Pepsi. What is the probability that 5 or 6 out of 10 randomly selected cola drinkers would choice Pepsi in a blind taste test?

P(X = 5 or 6) = P(X = 5) + P(X = 6) = ?

```
binomPdf(10,.4,{
5,6})
{.2006581248 .1…
```

use right ➔ to scroll

```
binomPdf(10,.4,{
5,6})
…248 .111476736}
```

add .20066 + .11148 **OR**

```
binomPdf(10,.4,5
)+binomPdf(10,.4
,6)
      .3121348608
```

Example: Assume 40% of the market prefers Pepsi. What is the probability that the first cola drinker to randomly select Pepsi in a blind taste test would be the fifth or sixth customer?

P(X = 5 or 6) = P(X = 5) + P(X = 6) = ?

```
geometPdf(.4,{5,
6})
{.05184 .031104}
```

add .05184 + .031104

OR

```
geometPdf(.4,5)+
geometPdf(.4,6)
           .082944
```

Example: Suppose the likelihood of Barry Bonds hitting a homerun is .2, what is the probability he will hit **ten or fewer** homeruns out of 30 attempts.

P(**X ≤ 10**) = ?

```
binomcdf(30,.2,1
0)
      .9743837444
```

Example: Suppose the likelihood of Barry Bonds hitting a homerun is .2, what is the probability he will hit his first homerun **within his first ten times** at bat?

P(**X ≤ 10**) = ?

```
geometcdf(.2,10)
      .8926258176
```

Example: Suppose the likelihood of Barry Bonds hitting a homerun is .2, what is the probability he will hit **ten or more** homeruns out of 30 attempts.

P(**X ≥ 10**) = 1 – P(X ≤ 9) = ?

```
1-binomcdf(30,.2
,9)
      .0610871482
```

Example: Suppose the likelihood of Barry Bonds hitting a homerun is .2, what is the probability he will hit his first homerun **after his first ten times** at bat?

P(**X > 10**) = 1 – P(X ≤ 10) = ?

```
1-geometcdf(.2,1
0)
      .1073741824
```