CH 16 PROBABILITY MODELS GUIDE

Bernoulli Trials – binary trials that measure the outcome

Conditions to be a Bernoulli Trial:

1) Two possible outcomes (success and failure)
2) Probability of success is constant (same chance every time)
3) Trials are independent

10% Condition – exception to 3rd condition of Bernoulli Trials

- *If trials are not independent (sampling without replacement), then it is ok to proceed with Bernoulli Trials as long as the random sample is smaller than 10% of the population.*

Geometric Probability Models – Used to model the probability of an event until the first success occurs (order matters)

Notation: Geom(p)

- *Means the probability of success (p) for a geometric probability model*

Variables	Formulas	Purpose of Formula
p=probability of success	**P(X = x) = $q^{x-1}p$**	Probability of Geometric Event
q = probability of failure *q= 1- p (complement rule)*	**E(X)=** $\frac{1}{p}$	Expected Value (mean/center) of Geometric Event
X = number of trials until 1st success	**SD(X) =** $\sqrt{\frac{q}{p^2}}$	Standard Deviation (spread) of Geometric Event

Calculator TI-83 and 84

Under **2ND DISTR** button, use the following to help you:

p=defines the probability of the model (success)

x = number of trials UNTIL success

Button	Purpose	Meaning
Geometpdf(p, x)	Probability of Individual Outcome *(1 Event)*	Probability Density Function
Geometcdf(p, x)	Probability of several outcomes *(sum)* *-When the success (event) can happen on or before the last trial*	Cumulative Density Function

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Binomial Probability Models – chance of an overall outcome, regardless of the order it occurs

(# of successes in specified #of trials- Binom(n,p)is the notation)

Variables	Formulas	Purpose of Formula
p= probability of success	$P(\mathrm{X}=\mathrm{x}) = {}_nC_x p^x q^{n-x}$	Probability of Binomial Event
q=probability of failure	${}_nC_x = \frac{n!}{x!(n-x)!}$	X successes in n trials
X= number of successes	**E(X) = np**	Expected Value (mean/center) of Binomial Event
n = number of trials	**SD(X) =** $\sqrt{npq}$	Standard Deviation (spread) of Binomial Event

Calculator TI-83 and 84

Under **2ND DISTR** button, use the following to help you:

Button	Purpose	Meaning
Binompdf(n,p,x)	Probability of Individual Outcome *(1 Event from number of trials)*	Probability Density Function
Binomcdf(n,p,x)	Probability of several outcomes *(sum)* *-Total successes x or fewer based on number of trials*	Cumulative Density Function

Success/Failure Condition: binomial model is approximately Normal if we expect at least 10 successes and 10 failures.

Means:	np ≥ 10	nq ≥ 10

Tips:

- Use your calculator to find most answers
- Check your conditions to see if something applies
- Geometric and Binomial are different
  - *Geometric – probability of when first success occurs (order matters)*
  - *Binomial – probability of any successes within the set amount of trials (order doesn't matter)*
- Use the Normal Model if the success/failure condition applies to continuous random variables to find the chance of the event

Example Diagram of Bernoulli Trials