

## Shapes of Binomial Distributions

by Randall Gallaher, Lewis & Clark Community College

### Course

MATH 145 (Elementary Statistics)

### Description

A calculator program will be used to graph binomial distributions for a given number of trials ( $n$ ) and a given probability of success ( $p$ ). The program asks the student to enter  $n$  and  $p$ . It then graphs the histogram of that binomial distribution. The purpose is for students to discover (1) if  $p = .5$ , then the distribution will be perfectly symmetrical, (2) if  $p < .5$ , then the binomial distribution will be skewed right, and (3) if  $p > .5$ , then the binomial distribution will be skewed left.

### Transferability

This module will transfer to any introductory statistics class or any class that discusses binomial probabilities.

### Faculty Technology Skill

Faculty members will need to be able to use a TI-83 Plus graphing calculator to run programs. Faculty members may also need to download a program and install it on their computers or servers. They should be familiar with transferring programs from a computer to a TI-83 Plus, or they should know how to key the program into a TI-83 Plus. Faculty should also be familiar with transferring programs to other TI-83 Plus graphing calculators via linking.

### Student Technology Skill

Students will need to be able to use a TI-83 Plus graphing calculator to run programs. Students may also need to be able to download programs to their computers and transfer them to their calculators, or they may need to know how to key the program into a TI-83 Plus or how to transfer programs to/from other TI-83 Plus graphing calculators via linking.

### Faculty Equipment

The faculty member will need a TI-83 Plus graphing calculator and a link cable to transmit the program (if needed). An Internet browser may also be required along with Internet access. The program *Binhist* will need to be entered or downloaded from another calculator or the Internet.

The program is available at <http://www2.lc.edu/mathsci/rgallaher/binhist.83p>.

Once downloaded, the program can be transferred to a calculator using *TI-Graph Link*.

### Student Equipment

The students need to have their own TI-83 Plus and a link cable to transmit the program (if linking). The program *Binhist* will need to be entered or downloaded from another calculator or the Internet. If downloading from the Internet, the student will need access to *TI-Graph Link* in order to transfer the program to his or her calculator.

### **Cost**

The only cost involved with this module is that of a TI-83 Plus graphing calculator (around \$100) and a *TI-Graph Link* (around \$25).

### **Improvement on Teaching and Learning**

By completing this module, students will hopefully gain a deeper understanding of binomial distributions. Particularly, they should learn how the probability of success affects the shape of the binomial distribution. They should see the three following main points: (1) if  $p = .5$ , then the distribution will be symmetrical, (2) if  $p < .5$ , then the binomial distribution will be skewed right, and (3) if  $p > .5$ , then the binomial distribution will be skewed left. What's more, they should see that the closer  $p$  is to  $.5$ , the closer the distribution will be to being symmetrical. The farther  $p$  is from  $.5$ , the more skewed the distribution will be. The use of technology allows for students to see many more examples of various binomial distributions than would be possible without it.

### **Nontechnology Comparison**

The same quality of learning obtained from this module could be realized without this particular module; however, the time required to tediously compute the binomial probabilities and then to graph the distribution impedes the ability to get a full appreciation of the affect of  $p$  on the distributions. By the time the computations are done and graphs are constructed, the students tend to lose focus of what they are ultimately looking for. Use of the TI-83 Plus enables students to focus more on interpretation and understanding than on computation and graphing.

### **Pertinent Issues**

Within the *Binhist* program, the number of trials ( $n$ ) is limited to 20 or less.

### **How to Use in the Classroom**

This module should be used after discussion of binomial probability distributions. The discussion should include the process of constructing histograms of discrete probability distributions. The intent is for the students to complete the module as either an in-class or out-of-class activity; however, if the instructor has the proper equipment, he or she could project his or her own calculator on the board and use this module as a class demonstration.

Shapes of Binomial Distributions  
*Elementary Statistics Module*

1. Obtain the *Binhist* program for the TI-83 Plus from your instructor.
2. Run the program using  $n = 10$  and  $p = 0.05$ .
3. Describe the shape of the histogram for the binomial distribution, being sure to use the terminology *skewed left*, *skewed right*, and/or *symmetrical*.
4. Run the program enough times to complete the table below.

$n$	$p$	Description of Histogram
10	.10	
10	.15	
10	.20	
10	.25	
10	.30	
10	.35	
10	.40	
10	.45	
10	.50	
10	.55	
10	.60	

10	.65	
10	.70	
10	.75	
10	.80	
10	.85	
10	.90	
10	.95	

5. For what value(s) of  $p$  was the distribution symmetrical?
  
6. For what value(s) of  $p$  was the distribution skewed left?
  
7. For what value(s) of  $p$  was the distribution skewed right?
  
8. Is the shape of the distribution dependent upon the value of  $p$ ? Make a general statement about the shape of a binomial distribution depending on the value of  $p$ .
  
9. Use different numbers of trials other than  $n = 10$ , and use various values for  $p$  to test your statement from above. Did your statement hold up? Explain.



Program:BINHIST

Full:RectGC:CoordOn

GridOff:AxesOn:LabelOff

FnOff :PlotsOff

ClrHome

Disp "BINHIST PROGRAM"

Disp " "

Disp " BY"

Disp "RANDY GALLAHER"

Disp "LEWIS AND CLARK"

Disp "COMM. COLLEGE"

Disp "GODFREY, IL"

Pause

ClrHome

Disp "THIS PROGRAM "

Disp "WILL GRAPH THE"

Disp "BINOMIAL"

Disp "DISTRIBUTION"

Disp "FOR THE VALUES"

Disp "OF  $n$  AND  $p$  THAT"

Disp "YOU INPUT."

Pause

Lbl 0

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ClrHome
Disp "ENTER n (n÷20)"
Input N
If N<1:Goto 0
If N>20:Goto 0
If int(N)≠N:Goto 0
Lbl 2
ClrHome
Disp "ENTER p (0<p<1)"
Input P
If P÷0:Then:Goto 2:End
If Pù1:Then:Goto 2:End
ClrHome
seq(X,X,0,N,1)üL_
binompdf(N,P)üL,
ú.5üXmin
N+.5üXmax
1üXscl
ú.1*max(L,)üYmin
1.1*max(L,)üYmax
0üYscl
Plot1(Histogram,L_,L,)
DispGraph
Pause
ClrHome

```

Disp "WOULD YOU LIKE"

Disp "TO DRAW ANOTHER?"

Disp "1 = YES"

Disp "2 = NO"

Input Z

If Z=1:

Goto 0

ClrHome