

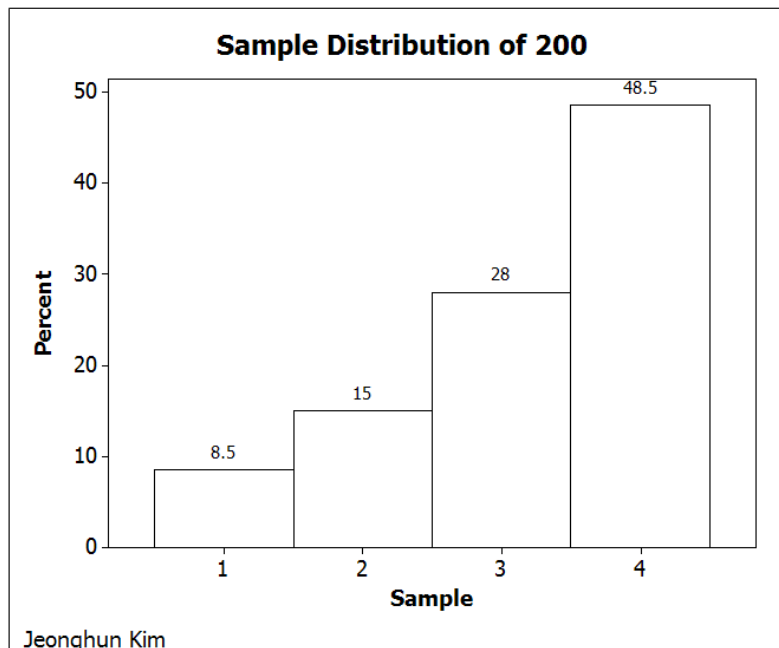
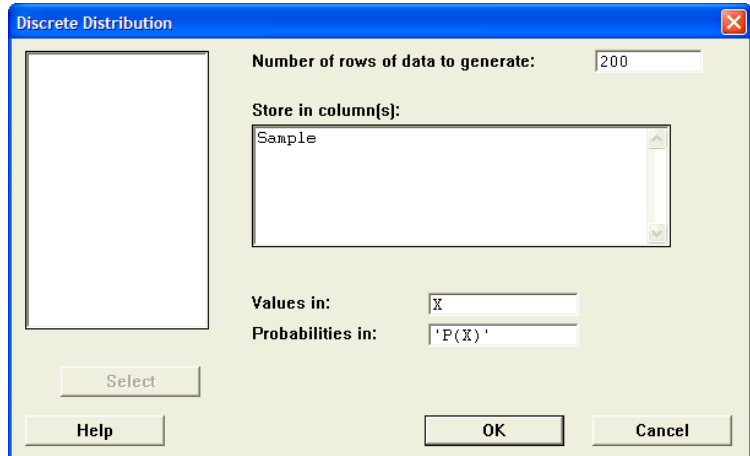
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## LESSON 8 - DISCRETE DISTRIBUTIONS

In this lesson we will explore some properties of discrete distributions. As an example we will look at a random variable with four outcomes,  $X = 1, 2, 3, 4$ , and related probabilities  $P(1) = .10$ ,  $P(2) = .15$ ,  $P(3) = .25$ , and  $P(4) = .50$ . Open Minitab, clear everything below the date/time stamp and type your name, Lesson 8, and Example on separate lines below the date/time stamp. Go to the data window, label C1 X and C2 P(X), then enter the above values into the columns. Display the two columns. Save this worksheet as ProbDist.mtw as you will need it again in Lesson 10. Now label C3 Sample.

To create a sample of 200 from this distribution click on Calc > Random Data > Discrete.

Type 200 into the "Number of rows of data to generate:" box. Select C3 Sample into the "Store in column(s):" box, select C1 X into the "Values in:" box, and select C2 P(X) into the "Probabilities in:" box. The dialog box should now look like the figure to the right. Click "OK". You should now have a sample of 200 in column C3. Now create a relative frequency histogram of Sample and add data labels to the tops of the bars. (See Lesson 3) You should now see a graph similar to the one shown below.



The title has been modified slightly and the percentages on your graph will probably not exactly match (because you will get a different random sample than what was obtained by the author) but they should be close. Notice also that the percentages are close, but not exactly what we expect. For example, we would expect 10% for  $X = 1$ , but have only 8.5%, and so on.

### MEAN AND VARIANCE

Now let us consider the mean and variance of this distribution. Using the formula from the text and a calculator we find

$$\mu = \sum X * P(X) = 1 * .10 + 2 * .15 + 3 * .25 + 4 * .50 = 3.15$$

and

$$\sigma^2 = \sum X^2 * P(X) - \mu^2 = 1^2 * .10 + 2^2 * .15 + 3^2 * .25 + 4^2 * .50 - 3.15^2 = 1.0275$$

Now use the basic statistics function of Minitab (see Lesson 5 and Lesson 6) to find the mean and variance of this sample. The complete session window for this example is shown in the figure to the right. Notice that the sample mean and sample variance differ a little from the mathematically expected values we calculated above, but not by much. Again, we should not expect the empirical results of any one random sample to match exactly the theoretical results.

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Lesson 8		
Examples		
<b>Data Display</b>		
Row	X	P(X)
1	1	0.10
2	2	0.15
3	3	0.25
4	4	0.50
<b>Descriptive Statistics: Sample</b>		
Variable	Mean	Variance
Sample	3.1650	0.9525

## MINITAB ASSIGNMENT 8

**See instructions on page 8.**

1. Consider Problem 35 on page 203. Do each of the following. Note that all of your answers will appear in the session window except for parts (b) and (c). The answers to parts (d), (e) and (g) will have to be typed in.

- (a) Enter the given probability distribution into the data window and display it as was done in the example above. Save the worksheet as Quiz.mtw as you will need it again for Lesson 10.
- (b) Create a sample of size 500 from this distribution.
- (c) Create a relative frequency histogram using the sample data from part (b). Include an appropriate title.
- (d) How do the sample relative frequencies compare with the probabilities?
- (e) Compute the mean and variance of this distribution (NOT of the sample).
- (f) Use Minitab to compute the mean and variance of the sample data from part (b).
- (g) How do your results of parts (e) and (f) compare?

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