Mega Millions Lottery

Minitab Project 1

The Mega Millions game is a lottery game that is played by picking 5 balls between 1 and 52 and additional megaball between 1 and 52. The cost per game is $1. The current version of Mega Millions began on May 17, 2002. Use only data from May 17, 2002 or later for this project. Since the lottery is played twice a week, the longer you wait to get started on this, the more data you will have to collect. Once you start answering the questions, stop gathering data.

Each person in your team should pick one lottery number. Pick your numbers BEFORE you gather the information. This information will be used later to see how well you would have done if you would have played the Mega Millions Lottery twice a week since May 17, 2002.

Name	Ball 1	Ball 2	Ball 3	Ball 4	Ball 5	Megaball

Information about the Mega Millions game can be found at
http://www.biggamelottery.com/

Gathering the data (10 points)

Visit the "Prior Results" page and enter the winning numbers into Minitab.

You can really speed this up if you will use Internet Explorer on the same computer as Minitab and follow these directions. Open both Minitab and Internet Explorer.

In Internet Explorer, highlight the 26 drawings it gives you at a time, copy it (control-C or Edit/Copy), switch to Minitab, and then paste it (control-V or Edit/Paste). When you paste, make sure you are in the data section and not the variable name section (make sure you start in row 1) and tell it to "use spaces as delimiters". Switch back to Internet Explorer and get the next set of data. Repeat this process until you have all of the information back through May 17, 2002.

When you are all done pasting in the information, then highlight the columns you don't need (by clicking on the column name at the top [example: C1-T] and hitting delete. Finally label the variables as ball1, ball2, ball3, ball4, ball5, and megaball.

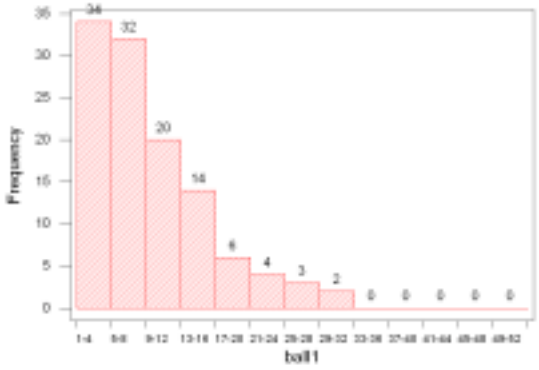
Label a blank column as "classes". Right click the mouse button on the column and choose Format Column / Text. In this column, enter the class limits for thirteen classes of width four, starting at 1 and ending at 52. The first few would be 1-4, 5-8, 9-12 and the last would be 49-52.

Save your data into the R:\01\LOTTERY folder. Pick a name unique to your group. Be sure to periodically save your projects and your Word document. You do not need to save the graphs within Minitab once you have copied them into Word.

Descriptives (35 points)

Histograms

Create six histograms, one for each ball including the megaball. Copy each histogram and paste it into a Word document. For each histogram describe the distribution using terms like uniform (flat), bell shaped, triangular, skewed to the right, skewed to the left, etc. A sample histogram is shown to the right.



ball 1 is skewed to the right

Instructions for Histograms

1. Go to Graph / Histogram
2. Click in the X column for graph 1 and then select ball1. Put ball2 into graph 2, ball3 into graph 3, ball4 into graph 4, ball5 into graph 5, and megaball into graph 6.
3. (Optional but recommended) Click on Edit Attributes and change the fill type to something other than solid. You may also change the fore color to something other than black if you want to. Hint: If you will highlight the entire column by clicking on the heading and then click on the down arrow, you can change all of the graphs at once. If you don't highlight the column first, you will only change the graph that is highlighted. Click OK when done.
4. Click on Annotation / Show Data Labels, and check the Show Data Labels box. Click OK.
5. Click on Options. Change the Type of Intervals to Cutpoint and the Definition of Intervals to Midpoint/Cutpoint positions. Enter 0.5:52.5/4 for the definition. This

will generate 13 classes from 1 to 52 with a class width of 4. Click OK.

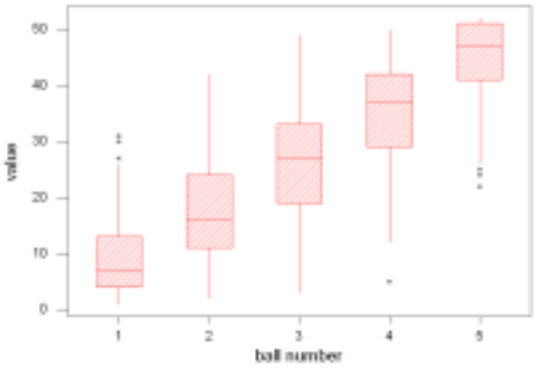
6. Click on Frame / Min and Max. Change the minimum X to 0.5 and the maximum X to 52.5. Click OK.
7. Click on Region / Data. Change the minimum X and Y to be 0.15 and the maximum X and Y to be 0.95. Click OK.
8. Click on Frame / Tick. Make the following changes to Tick 1 (the X's): On the top section, change the number of Major ticks to 14 and the number of Minor ticks to 0. On the bottom section, change the Labels to "classes" (without the quotes), the Text Size to 0.8, the Horizontal Placement to the right of (click on the cell and then click the down arrow button) and the Vertical Placement to below. Click OK.
9. Click OK to generate the graphs.
10. Copy each graph with Control-C (or Edit / Copy), switch to Word, and Paste with Control-V (or Edit / Paste). Describe the shape of the distribution. Repeat for the other five graphs.

Boxplot

Make a boxplot with each of the five balls on it.

Instructions for Boxplot

1. Go to Manip / Stack / Stack Columns. Stack columns ball1-ball5 and store them in a new worksheet called combined (or something similar). Uncheck the "use variable names in subscript column". Click OK.
2. Switch to the original data window and copy the classes column. Switch back to the new worksheet and paste the classes column into a blank column.
3. Rename the "subscripts" column to be "ball number" and label the C2 column as "value".
4. Go to Graph / Boxplot
5. Graph the value (Y) vs the ball number (X).
6. (Optional) Click Edit Attributes and change the fill and fore color. Click OK.
7. Click on Region / Data and change the minimums to 0.15 and the maximums to 0.95. Click OK.
8. Click OK.
9. Copy the graph and paste it into Word. Describe what you see from the boxplot.



Checking Normality

See if ball 3 and the megaball are normally distributed.

We've already looked at the histogram, but there are other ways that we can check normality. This technique uses the normal probability plot and the Anderson Darling hypothesis test.

Read section 5.7 for instructions on how to interpret the normal probability plot (also known as a QQ plot or quantile-quantile plot). The null hypothesis for the Anderson Darling test is that the data is normally distributed. You'll have to decide, based on the p-value, whether your data is too unusual for that assumption to be true.

Instructions for checking normality

1. Make sure the active spreadsheet is the original data.
2. Go to Stat / Basic Statistics / Normality Test.
3. Select the ball3 variable and click OK.
4. Copy the graph and paste it into Word.
5. Repeat the process, except this time use the megaball variable.
6. Interpret both graphs.

Descriptive Statistics

Give summary statistics for each of the five balls and the megaball.

This section is pretty straight forward so I'm not giving sample output.

Instructions for Descriptive Statistics

1. Go to Stat / Basic Statistics / Display Descriptive Statistics
2. Select all five balls and the mega ball for the variables. Click OK.
3. Highlight the output, copy, switch to Word, and paste it.
4. Explain anything interesting you see in the data.

Uniform Distribution

Supposedly, the balls in the lottery have a uniform distribution. This means that each ball occurs with equal frequency. One of the assumptions of a uniform distribution is that the mean is the midpoint between the high and low values (also known as midrange). For the lottery that should be (52+1)/2 = 26.5. So we'll test to see if the mean of the different games is 26.5. The null hypothesis is that the mean is 26.5. If your results are too unusual, then you'll have to reject that assumption.

Instructions for Checking Mean

1. Label two blank columns as "mean" and "st dev"
2. Go to Calc / Row Statistics
3. Choose the mean, use ball1 through ball5 for the input variables, and store the result in the "mean" column.
4. Repeat steps 2 and 3 except calculate the standard deviation and store it into the "st dev" column.
5. Go to Stat / Basic Statistics / 1-Sample t.
6. Choose "mean" for the variable and enter 26.5 as the test mean. Click OK.
7. Copy the output and paste it into Word.
8. Interpret the results based on the p-value.

Another assumption is that the standard deviation of a uniform distribution is $\sigma = \frac{\max - \min}{\sqrt{12}}$. For the lottery, that would be $\sigma = \frac{52.5 - 0.5}{\sqrt{12}} \approx 15.011$. Okay, I know you're saying the max is 51 and the min is 1, but the uniform is technically a continuous distribution, not a discrete one, so we go with the boundaries instead of the limits. Remember earlier when we were setting the cutpoints for the histograms ... we used 0.5 and 52.5. Anyway, we're going to look at the standard deviations and see if they're close to 15.011. Unfortunately (for statisticians although you'll probably appreciate it), Minitab won't compare a standard deviation the way that it does for means. This means that we're going to have to just eyeball the results and see if it seems reasonable.

Instructions for Checking the Standard Deviation

1. Find the descriptive statistics for the "st dev" variable.
2. Copy the output and paste it into Word.
3. Look at the mean of the variable. Does is seem close to 15.011? Comment on whether it looks unusual or close enough to be considered normal variation.

Your Winnings

Here's where we check the numbers that your team picked and see how well you do.

Instructions for checking your winnings

1. Go to the website for the Big Game Lottery and click on Search.
2. Enter the numbers for the players on your team
3. Click "Search Prior Results"
4. Record the number of times May 17, 2002, or later that you would have won each of the prizes into a table similar to the one shown below. Ignore those prizes before May 17, 2002.
5. Make a table in Word that summarizes your winnings (see below).
6. Analyze the winnings to come up with the total winnings, total amount spent, and average winning (or loss).

Sample Output

Frequency of prizes for the numbers
5-9-15-18-29 [12] and 1-8-26-32-50 [45]

Prize	Jackpot	$175K	$5,000	$150	$10	$7	$3	$2
#	0	0	0	0	0	1	0	1

The total winnings for our group were $9. We played 2 tickets for 115 games or 230 tickets, so it cost us $230 to play. Our net winnings are -$221. Our average winnings per game is -$221 / 230 = -$0.96 or a loss of 96¢ for each $1 played.

Final Report

Make sure your names are at the top of the Word document. Describe the dates for which you collected your lottery information (May 17, 2002 through ____) and the number of lottery drawings there were during that time.

Print out the report and give it to the instructor.

Evaluations (5 points)

Each student should do the following. This portion is not a group effort, it is an individual activity. It must be typed and printed, no handwritten papers.

- Put your name and section at the top of the paper
- For each person in your group (including yourself), give their name and assign them a score between 0 (lowest) and 5 (highest) for their effort in making this project a success. Then write a short paragraph about what each person contributed and why they deserve the grade you're giving them.

Example Evaluation:

Steve Jackson – 5
I am a hard worker who really knew how to use the computer to do Minitab and Word. I wasn't very good at understanding the statistical side of things but I was a good organizer and kept us on task. I was always there and stayed late a few times.

Bob Smith – 1
Bob is a bum! I don't know why I ever picked him to be in my group. I should have known better than to pick the person who sat next to me as a partner. Bob missed half of the class periods we spent working on this project. When we did work together in class, he was playing on his cell phone instead of helping with the project. The only reason he gets 1 point is because he knew that a p-value < 0.05 meant to reject the null hypothesis.

Due Dates

This project and the evaluations are due Tuesday, July 8, 2003.