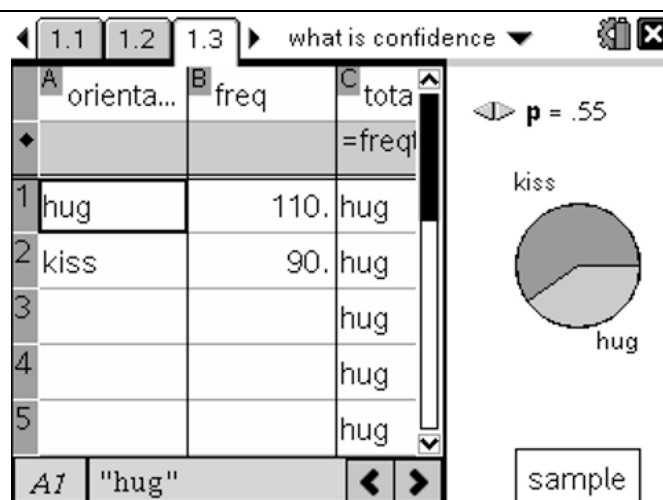


# Simulation: What is a confidence interval?

This activity is based on a simulation designed by Floyd Bullard. To start, I show students a plastic bag containing 200 candy kisses. The bag has regular kisses and hugs (the milk chocolate kiss hugged by sweet white cream). I proceed to take a random sample of 20 candies and find the proportion of hugs in our sample ( $\hat{p}$ ). A quick poll can be sent asking students what is the highest value of the population proportion that they think the sample could have come from.

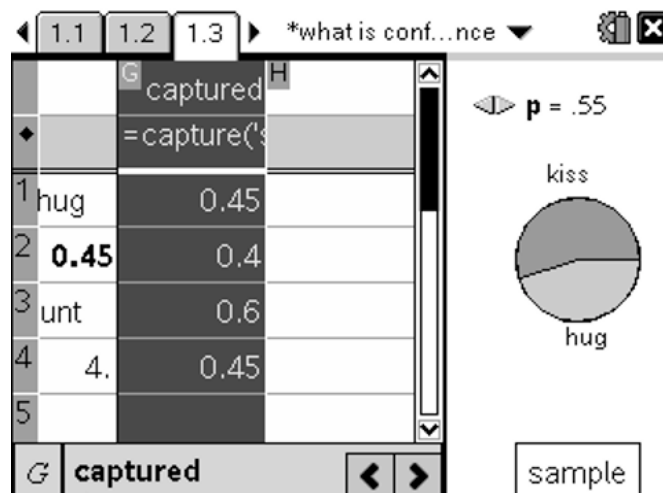
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Students will **imagine** that they have their own bag of candies filled with 200 hugs and kisses. Each student will be assigned a proportion that will represent the true proportion of hugs in his/her bag. To change proportions, students must enter **(ctrl) (tab)** to switch to the right pane. Then they may use the slider to adjust their population proportion accordingly. Some students prefer to click on the slider and type in their proportion's value.



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As students change their slider, column G will be collecting sample proportions that will need to be deleted. Students should arrow up to the top of the column until it is highlighted.



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To erase the data, hit **(menu)** and then select **(3)** for Data followed by **(4)** to Clear the data.

The screenshot shows the Minitab 'What is confidence' window. The 'Data' menu is open, and the path to 'Clear Data' is highlighted: 1: Generate Sequence, 2: Data Capture, 3: Fill Down, 4: Clear Data, 5: Frequency Plot, 6: Quick Graph. The background shows a table with columns 'captured' and 'hug'.

	captured	hug
2	0.45	0.4
3	unt	0.6
4	4.	0.45
5		

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When students type **(ctrl)R** a new sample of 20 candies will be collected and it's sample proportion of hugs will be stored in column G. Students should stop when the count (cell F4) is at 40.

The screenshot shows the Minitab 'What is confidence' window. The 'Data' menu is open, and the path to 'Clear Data' is highlighted: 1: Generate Sequence, 2: Data Capture, 3: Fill Down, 4: Clear Data, 5: Frequency Plot, 6: Quick Graph. The background shows a table with columns 'captured' and 'hug'.

	captured	hug
1	hug	0.45
2	0.35	0.4
3	unt	0.6
4	40.	0.45
5		0.6

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If students don't see a dot plot of their captured sample proportions, then they should adjust their window accordingly by entering **(menu)** and choosing option **(5)** followed by option **(2)** (Zoom-Data)

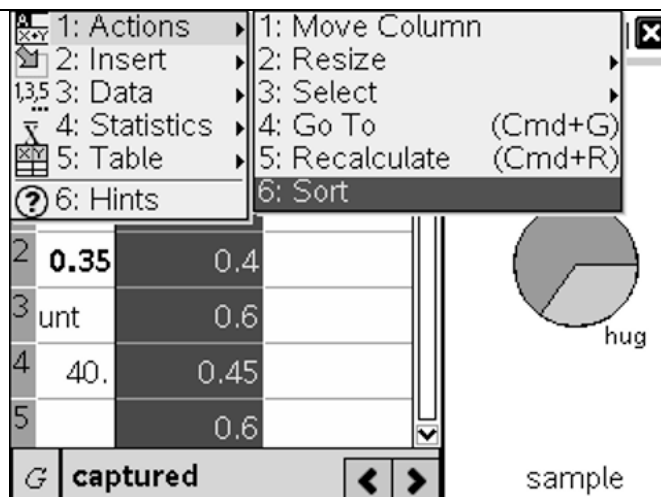
The screenshot shows the Minitab 'What is confidence' window. The 'Window/Zoom' menu is open, and the path to 'Zoom - Data' is highlighted: 1: Window Settings, 2: Zoom - Data, 3: Zoom - In, 4: Zoom - Out. The background shows a dot plot of captured sample proportions.

captured

true proportion 0.55

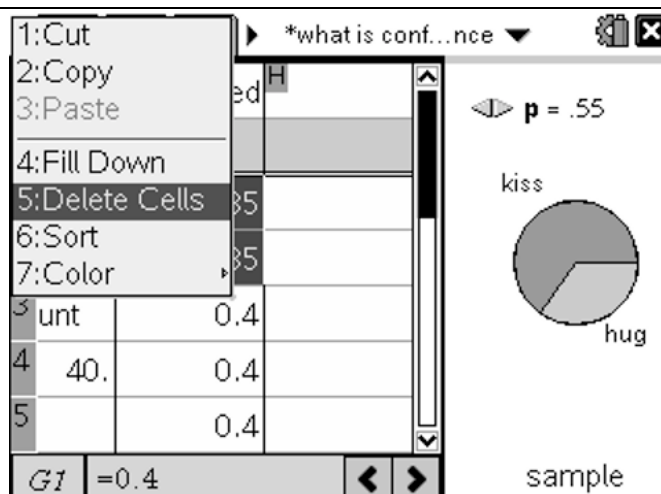
## Page 1-3

Let's have students eliminate their two highest and two lowest sample proportions so we may decide what sample proportions are "typical" for their bag. Students may do this by looking at their pictures or by sorting the "captured" column and then deleting the two highest and two lowest scores. First, move the cursor to the top of the column until it is highlighted. Next, enter (menu) followed by (1) (Actions) followed by (6) to sort. Students should follow the pull down menus and choose ascending.



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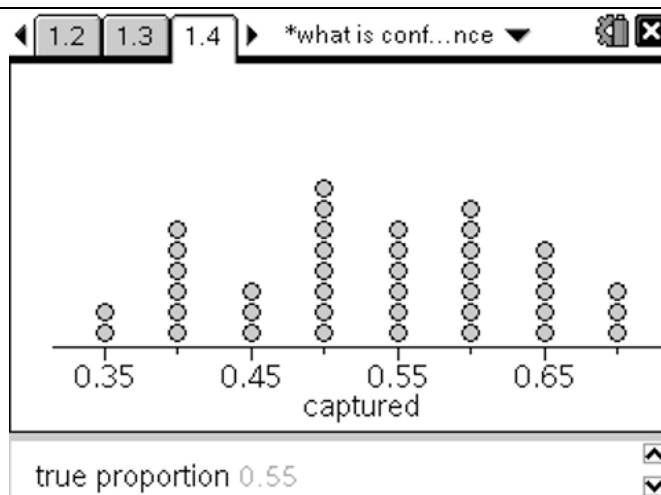
To delete cells, highlight one cell, hit (shift) then the down arrow. This will select multiple cells. Then press (ctrl) (menu). Choose option (5), Delete Cells. Repeat this process until you have deleted the two lowest and highest values. The values deleted may be repeats. Remind students that (ctrl) (1) will bring them down to the bottom of a column while (ctrl) (7) brings them back to the top.



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If you are using the Navigator, you will be able to capture all the screens and decide what population proportions your sample proportion could have come from.

At the start, we suggest assigning the population proportions to students so that when viewed as screen captures, the population proportions are in ascending order.



- If you do not have a Navigator, you may have students write down the interval of sample proportions that is consistent with their population values on an index card. Students can line up from lowest to highest and step forward if my sample proportion could have come from their population.
- You may repeat the procedure for bags containing different proportions of hugs.
- Once you have the interval, you might want to discuss why our confidence level is 90%. One person in the class has the same population parameter as my bag of hugs and kisses. Let's call that person Ian. The question "what is the probability that our confidence interval will capture the true proportion of hugs from my bag?" is equivalent to what is the probability that I get a sample proportion of hugs that is typical for Ian's bag?" Since, Ian's imagined bag is identical to my bag, the question becomes "what is the probability that if I sample 20 candies from Ian's bag, I'll get a sample proportion that is typical for Ian's bag. Now it's easy to see it's 90% because Ian already eliminated the highest and lowest 5% leaving the middle 90%.