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## Sharing Birthdays

ID: 12649

Time required  
45 minutes

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### Activity Overview

*In this activity, students use simulations to answer a popular question involving probabilities. They will use the **randInt** and **mean** commands to determine the average number of people that need to be in a room to share a birthday.*

### Topic: Statistics and Probability

- *Understand and apply basic concepts of probability*
  - *Understand and use appropriate terminology to describe complementary and mutually exclusive events*
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### Teacher Preparation and Notes

- *TI-Navigator is not required for this activity, but an extension is given for those teachers that would like to use it.*
- ***To download the student worksheet and TI-Navigator files, go to [education.ti.com/exchange](http://education.ti.com/exchange) and enter “12649” in the quick search box.***

### Associated Materials

- *MGAct30\_Birthday\_worksheet\_TI73.doc*
- *MGAct30\_Nav\_01\_TI73.act*
- *MGAct30\_Nav\_02\_TI73.act*

### Suggested Related Activities

*To download the activity listed, go to [education.ti.com/exchange](http://education.ti.com/exchange) and enter the number in the quick search box.*

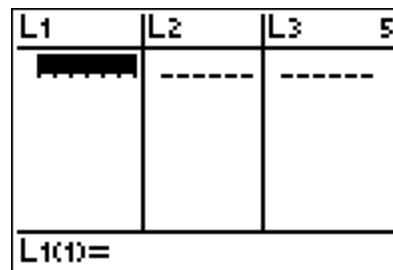
- *The Birthday Problem (TI-73 Explorer & TI-Navigator) — 6698*
- *What Are the Chances? (TI-73 Explorer) — 5224*
- *Random Rainbow Ratios? (TI-73 Explorer) — 8331*

**Problem 1 – Birthdays in Your Class**

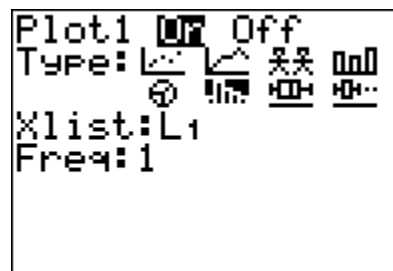
In this problem, students will collect data for the birthdays had by each person in the class. Students should assign a 3- or 4-digit number for their birthday, 101 being January 1<sup>st</sup> and 1015 being October 15.

Questions 1-2

Ensure students understand the format needed for their birthday. You may want to have them write their birthday (April 21) along with the number (421). To collect the data into one list, you may want to have students read off their numbers and you enter the values into **L1** or have them come one at a time to your calculator and enter the values.



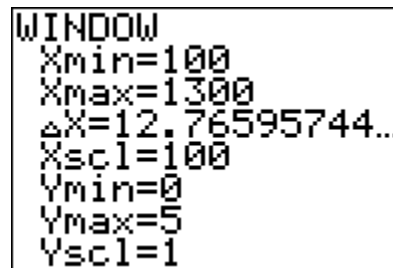
Press **[LIST]** to access L1. If there are data values in L1, you can move to the top of the list (**[▲]**) and press **[CLEAR]** **[ENTER]**.



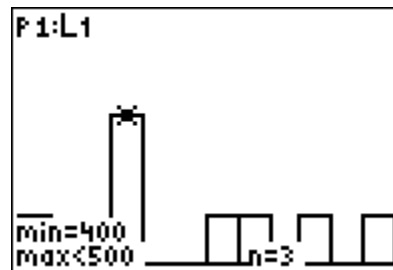
Once all the numbers have been entered, you can send the large list back to all calculators. Connect two calculators using the unit-to-unit cable and press **[APPS]** **[1]** **[4]** to select sending a list.

Questions 3-6

After students have received the whole list, have them set up a histogram using the data in L1. Press **[2nd]** **[Y=]** **[ENTER]** to access the **Plot1**. After the plot is set up, students should press **[WINDOW]** to adjust the viewing window to see the data. If any of the bars extend past the top of the screen, continue adjusting the Ymax value.

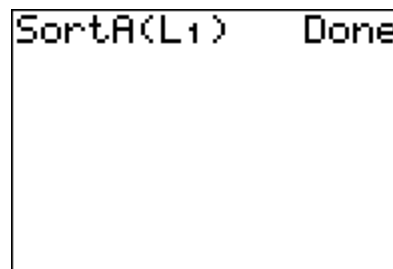


For the example shown at the right, there are 3 birthdays in April. Pressing **[TRACE]** and using the left and right (**[◀]** and **[▶]**) arrow keys will allow students to see the number of birthdays per month.



Questions 7-8

Have students sort L1 to see if any of the numbers are the exact same. Press **[2nd]** **[LIST]** **[▶]** **[1]** to select the **SortA** command and then press **[2nd]** **[LIST]** **[ENTER]** to enter L1. Then press **[LIST]** to view L1. If there are two numbers the same, this means students share that birthday. It will not be unlikely for students to find shared birthdays in a class or 20+ students.



**Problem 2 – A 50/50 Chance of Sharing a Birthday**

In this problem, students will generate random “birthdays” to perform a simulation of how many people need to be in a room before you have a greater than 50/50 chance of at least two people sharing a birthday.

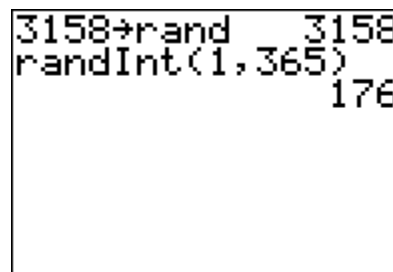
Questions 9-10

Students will likely initially guess a very large number of people that need to be in the same room in order to have two people share a birthday. Through this simulation, they will discover that the number is much smaller than expected.

To begin, ensure that all students set a different random number seed. This will ensure they generate different random numbers for the experiment.

Questions 11-14

Have students enter a unique number, either their student ID or the last four digits of their phone number, and store it to the random number seed. Enter the number, press **STO►** **MATH** **►** **►** **ENTER** **ENTER**.

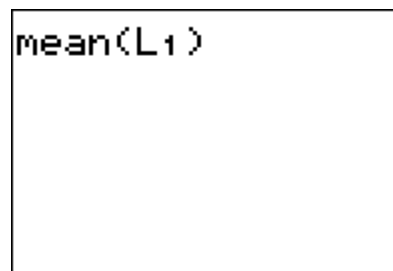


Then, students will select the **randInt(** command (under **MATH** and **PRB**) to generate random birthdays.

Students will record each random number generated and then will note when they receive a duplicate number. With the randomness of the simulation, each student will receive different numbers as well as different numbers of “people” in the room before a duplicate birthday is found.

Questions 15-17

Students will likely be surprised by the results of the experiment. Find the mean by pressing **2nd** **LIST** **3** **2nd** **LIST** **1** **ENTER**. The mean number of people needed in a room should be close to 23 people.



**Extension – TI-Navigator™**

1. For Problem 1, load the activity settings file **MGAct30\_Nav\_01\_TI73.act** into Activity center. This will set up a list on the students’ calculators for them to use for entering their birthday number.

Next, you can configure a **Frequency Plot** and/or send the data back to the students to continue with the activity given in Problem 1.

2. For Question 9, use **Quick Poll** to collect students’ initial guesses.
3. For Question 15, load the activity settings file **MGAct30\_Nav\_02\_TI73.act** into Activity Center. After students enter their individual list of data in L1, have them log into **NavNet** and press **SEND**. This is a faster method of compiling the numbers generated by each student.
4. Use **Screen Capture** throughout the lesson to monitor student progress.

**Solutions – student worksheet****Problem 1**

1. Answer is based on students' birthdays.
- 2-3. Data will vary.
4. The window will vary but should have  $X_{min}=100$ ,  $X_{max}=1300$  and  $Y_{max}$  will need to adjust based on the number of students born per month.
5. Graphs will vary.
6. Graphs will likely indicate that birthdays are spread out throughout the year.
7. Answers will depend on data collected. It is likely that 2 or more students will share the same birthday.
8. Answers will depend on data collected and student's expectations. It will be likely that students are surprised if two or more students share the same birthday.

**Problem 2**

9. Answers will vary.
- 10-11. List is based on initial rand seed students use. All lists should be different.
12. Answer should reflect data collected in Question 11.
13. It is very likely that the number found in Question 12 will be less than students' initial expectations in Question 9.
14. Students will likely be surprised by the results.
15. Graphs should show that most values center around the mean, 23.
16. Answers will depend on data collected but should be close to 23.
17. Very likely, the class average will be lower than the initial guess in Question 9. Explanation should indicate understanding of the probability as shown through the simulation.