Are There Any Seats Left?

Activity Overview

This activity allows students to use a simulation to understand why airline companies routinely overbook flights.

Topic: Simulations

- Understand and apply basic concepts of probability
- Use proportionality and a basic understanding of probability to make and test conjectures about the results of experiments and simulations

Teacher Preparation and Notes

- **To download the student worksheet, go to education.ti.com/exchange/atasl**

NORMAL FLOAT AUTO REAL RADIAN MP

randInt(1,10,25)→L₁
{5 10 7 9 6 2 9 10 8 8 8 ▸

This activity utilizes MathPrint™ functionality and includes screen captures taken from the TI-84 Plus C Silver Edition. It is also appropriate for use with the TI-83 Plus, TI-84 Plus, and TI-84 Plus Silver Edition but slight variances may be found within the directions.

Compatible Devices:
- TI-84 Plus Family
- TI-84 Plus C Silver Edition

Associated Materials:
- Are_There_Any_Seats_Left_Student.pdf
- Are_There_Any_Seats_Left_Student.doc

Tech Tips:
- Access free tutorials at http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials
- Any required calculator files can be distributed to students via handheld-to-handheld transfer.

Part 1 – Empty or Full Seat

Discuss with students how airlines routinely overbook flights to help ensure that the flight is full. There is a typical "no show" factor for flights. In this situation, you will work with a flight that holds 25 people and historically 20% of the people do not show for the flight.
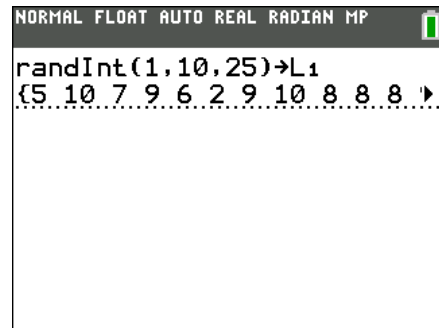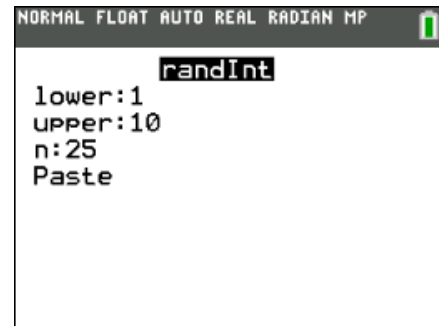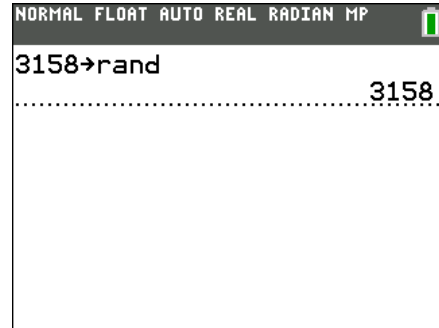
Questions 1–3

To begin, each student should store a different number to the random seed. This can be the last four digits of their home phone number, a portion of their student ID number, or another unique number. To do this, enter the number on the home screen, then press [STO▶] [MATH] ► ► ► [ENTER] [ENTER].

Next, students will enter the function shown at the right and store the generated list to L1. To enter the function, press the following. [MATH] ► ► ► [5] (to find **randInt**) A wizard will open if the MODE setting has STAT WIZARDS: ON. Fill in as shown. Highlight Paste and press [ENTER].

Press [STO▶][2nd][L1][ENTER].

25 random integers from 1 to 10 inclusive will be generated and stored in L1.

Questions 4–6

After this first list is generated, have students look at the list to get a sense for how many people did not show. In this case, since 20% of people historically have not shown, let the numbers 1 and 2 represent someone that purchased a ticket and did not show up for the flight. Since each student entered a unique seed for the random number generator, most lists should be different.

Now students will sort the list so 1 is at the top. Use the **sortA(** command under [2nd] [LIST] OPS to sort the list. This will make it easier to identify the people that did not show for the flight. (1s and 2s).
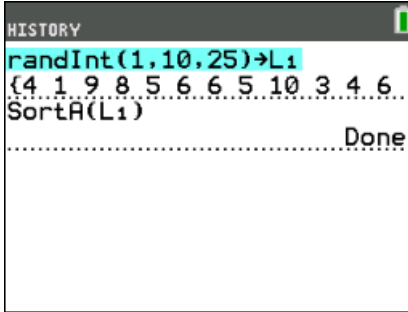
Questions 7–10

In the next set of questions, students should start gathering more data from the class results. Through this additional data, they should see that few, if any, flights were actually full if only 25 tickets were sold.
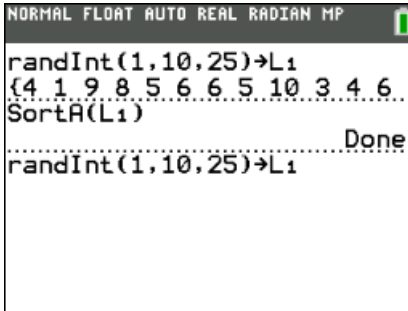
To repeat the process, students can return to the Home Screen, and up arrow to highlight the randInt command;

pressing [ENTER] will copy the command to the execute line;

and pressing [ENTER] once more will generate a new list of random numbers.

This will lead them to the next problem, determining how many tickets they should sell to help ensure the flight is full.

Part 2 – Oversold Seats

<u>Questions 11–13</u>

In this set of problems, students will modify the original random number function to increase the number of "tickets" sold.

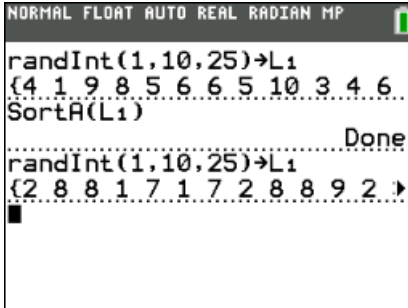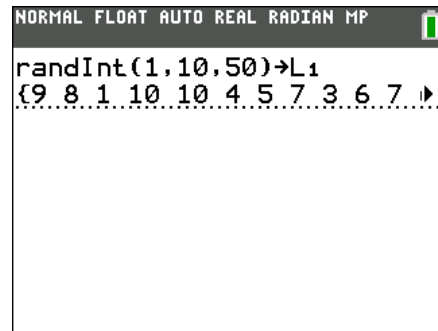To do this, students can return to the Home Screen, and up arrow to highlight the randInt command; press ENTER to copy the command to the execute line; use the left arrow key to move the cursor to over the 2 in 25 and press 5 0; then press ENTER.

Students will then look through the list (in order) and count the number of tickets that were sold before the flight is full.

In this case, students should NOT sort the list but use it in its original order.

<u>Questions 14–15</u>

The last two questions allow students to draw conclusions and wrap up the ideas presented in the lesson. If desired, you can have students repeat the simulation for the 30% scenario. In that case, students would consider the numbers 1, 2, and 3 as a no-show for the flight.

Solutions – Student Worksheet

Part 1

1. Set up the random number generator. Enter the number given by your teacher. Then press [STO▸] [MATH] ► ► ► [ENTER] [ENTER].

    Answer: Students will set up the random number generator.

2. On the Home screen, enter the function shown at the right. Press [MATH] ► ► ► and select **5:randInt(** to enter the **randInt** function.

    Answer: Lists will vary based on the random number seed entered in Question 1.

3. Explain in words what the function is calculating.

    Answer: The function generates 25 random numbers between 1 and 10 inclusive.

4. Look at the list in L1 (press [STAT] and select **1:Edit…**) and write down your numbers.

    Answer: Lists will vary based on the random number seed entered in Question 1.

5. Go back to the Home screen and sort your list in ascending order. Press [2nd] [LIST] ► [1] [2nd] [L1] [ENTER]. Write your ordered list here.

    Answer: This list is the list from Question 4 in increasing order.

6–7. **Answer: Answers will vary.**

8. Repeat the steps in Questions 2 and 5 four additional times (for 5 flights total). Were any of your flights full? **Answer: Answers will vary but most flights should not have been full.**

9. How many empty seats were on each flight? **Answer: Answers will vary.**

10. How many seats do you think you might need to sell to ensure the flight is full each time? Explain.

    Answer: Answers will vary. Students' explanation should be supported by information gathered in the activity.

Part 2

11–12. **Answer: Answers will vary.**

13. How do the numbers of tickets sold for your flights compare to others in the class?

    Answer: Answers will vary but the number should be similar among students.

14. If you ran the company, how many extra seats would you sell to ensure that the flight is full each time? Explain. **Answer: Answers will vary based on data gathered by students. Answers should be close to 30 seats.**

15. What if the no-show rate was 30%? How many seats would then need to be sold to ensure the flights are full each time? **Answer: Answers will vary based on data gathered by students but should be close to 35.**