

CASIO Statistics Activities
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Birthday Problem

A classical statistics probability problem is "What is the probability of having at least two people with the same birthday (day and month, not year) in a group?" The theoretical probabilities by size of group are quite easy to calculate and will surprise many people.

To begin, you do an easier example by asking "What is the probability of two people being born during the same month?" You know that if there are 13 people then there must be at least two born during the same month.

To calculate the probability of at least two born during the same month from a group with 4 people, first the number of birth month possibilities is $12^4 = 20,736$. The number of possibilities of not any having the same birth month is the permutation of 12 taken 4 at a time ($P(12,4)$) which is

$$\frac{12!}{8!} = 11,880$$

The number of possibilities of at least two birthdays in the same month would be:

$$20,736 - 11,880 = 8856$$

Then probability of at least two birthdays in the same month would be:

$$8856/20736 = 0.427$$

This easier example can be used to derive a general equation for at least b having the same birth date from a group with size g .

Probability of at least two people having the same birth date month from a group of g people is: (Use 12 if calculating same month or 365 if calculating same date)

$$\Pr(g) = \frac{12^g - \frac{12!}{(12-g)!}}{12^g}$$

or

$$\Pr(g) = \frac{365^g - 365 \times 364 \times 363 \times \dots \times (365 - g + 1)}{365^g}$$

1. Use this formula to calculate the probability of at least two people being born in the same month from a group of 6 people.

2 Complete the following table by calculating the probabilities of at least two people being born the same day of the year from groups of size 2, 10, 25, 30 and 60.

Group Size	Probability
2	
10	
25	
30	
60	

People are really surprised by these results since with a group of only 25 people you have a 57% chance of two having the same birthday.

Graph the above data as a scatterplot and sketch the scatterplot below.

Calculate the best fit regression equation for this graph.

Compare this regression equation to the probability equation given earlier in the lesson using 365 days.

Teacher Note: The answers for problem 2 are:

Group Size	Probability
2	<1%
10	12%
25	57%
30	71%
60	>99%

Keystrokes for the fx-9750G Plus

From the Main Menu, press 2 for STAT.

If there are data in List 1, follow these directions:

- Press F6 (make sure that the highlighted cell is List 1 by pressing the right/left arrow)
- Press F4 (delete all) then press F1 (yes)

Enter Data:

- Type the data into List 1 and List 2.
With appropriate cell highlighted, type numerical value then EXE to store.

Find One-Variable Statistics:

- Press F2 (calculate) then F6 (set)
- With 1-Var Xlist highlighted, press F1
- Press EXIT
- Press F1 (1-variable)
- Use the down arrow key to scroll for more values

Create a scatterplot and calculate regression equation. In the STAT mode

- Press EXIT
- Press F1 (graph), F4 (make sure Graph 1 is turned on) then press EXIT
- Press F6 (set), Press down arrow key to Graph Type then press F1 for Scatterplot.
- Press down arrow key to Xlist, press F1, press 1 (List 1), EXE, repeat for List 2, then frequency 1.
- Press EXIT, F1 for Graph 1 and the graph should appear
- Press F1 to calculate a regression equation. For this activity, you will press F6 twice then F1 to calculate the logistic regression equation.
- You can then copy it in the Y= screen and also graph the regression equation using F5 and F6.
- To Trace, press SHIFT F1

If your graph does not appear, follow these directions:

- Press SHIFT then MENU

- *Press F1 to change STAT Window to Auto*
- *Press EXIT*

To graph an equation:

- Be sure you are in GRAPH mode.
- Enter the equation into the graph editor.
- You may set the window by pressing 2nd F3 or just use the DRAW function.