

Exercise: Using **VITonline** to run a randomisation test

This exercise will enable you to use [VITonline](#) to run a randomisation test for an experiment.

VIT has a Randomisation test module that is used for testing how "significant" our difference is. We can use randomisation tests to see if our experimental results could be produced just by the "luck of the draw".

The skills addressed are:

- Use [VITonline](#) to re-randomise data and create a re-randomisation distribution.
- Interpret the re-randomisation distribution and tail proportion.

INSTRUCTIONS

Follow the instructions below to generate the graphs. If you have a problem doing the exercise, scroll down to **Common questions**.

- Start [VITonline](#) and select the **Randomisation Test** option.
- Load the **CanadaPop.csv** data set from **Example Data**.

This data (**CanadaPop.csv**) is based on an experiment where the researcher asked 19 students to estimate (in millions) the population of Canada (see Utts, J. M. & Heckard, R. F. (2014). *Mind on Statistics*, (5th ed.). USA: Cengage Learning.) The researcher was interested in whether the answers to a question may be influenced by information given with, or in, the question. This is called an "anchoring effect".

Students were randomly allocated to two groups and the question asked was phrased in two different ways.

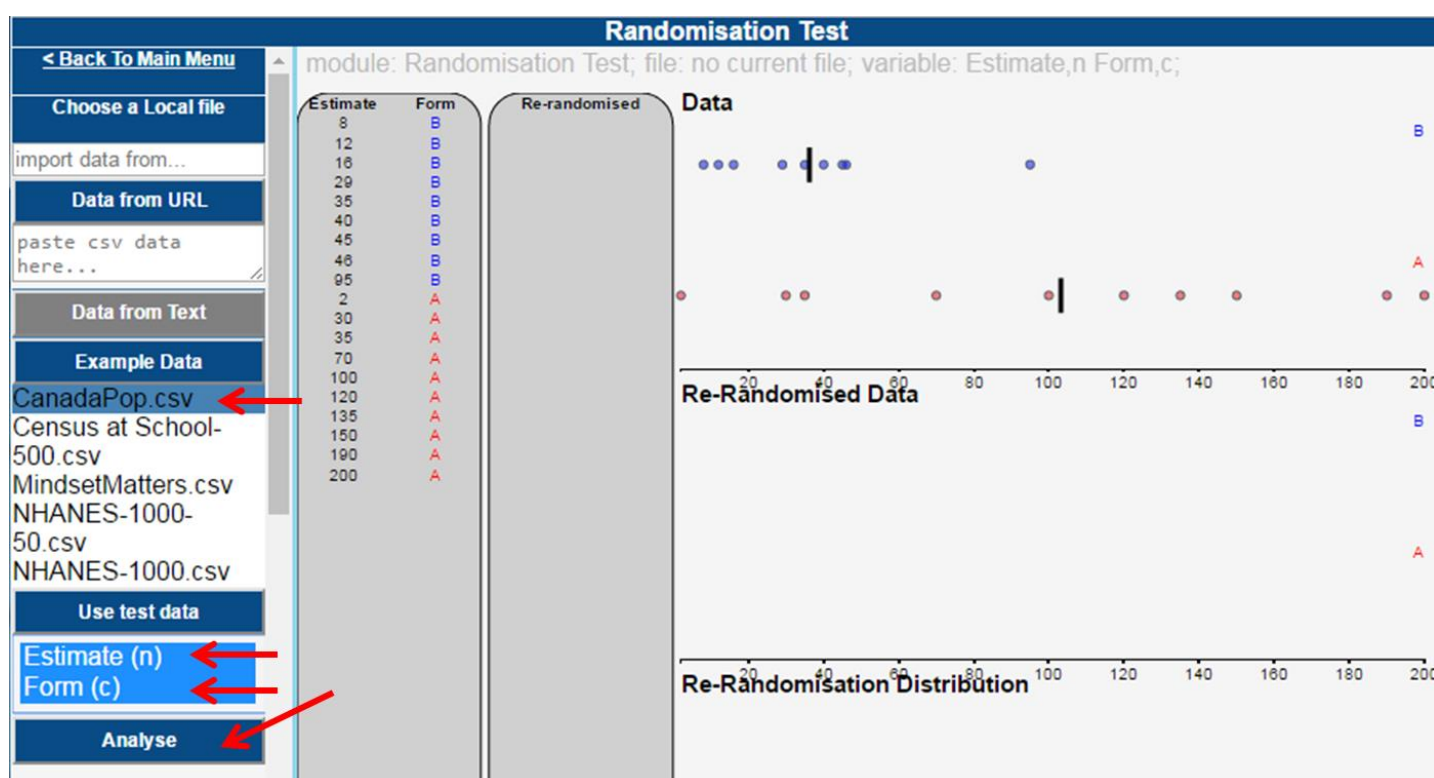
Group A were asked: "The population of the U.S. is about 270 million. To the nearest million, what do you think is the population of Canada?"

Group B were asked: "The population of Australia is about 18 million. To the nearest million, what do you think is the population of Canada?"

The variable **Estimate** contains their guesses/estimates of Canada's population.

Creating a re-randomisation distribution

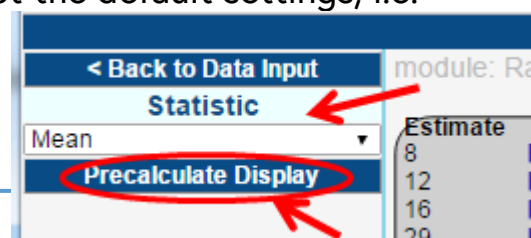
In the variable list, click on the variable **Estimate** and then click the variable **Form** while holding the **Control** key down so both variables are selected (it may be **Command** on Mac).



The graphics window will show the values of the **Estimate** variable and **Form** used on the left hand side and a dot plot of the estimates on the right.

Now click on the **Analyse** button at bottom left. Accept the default settings, i.e.

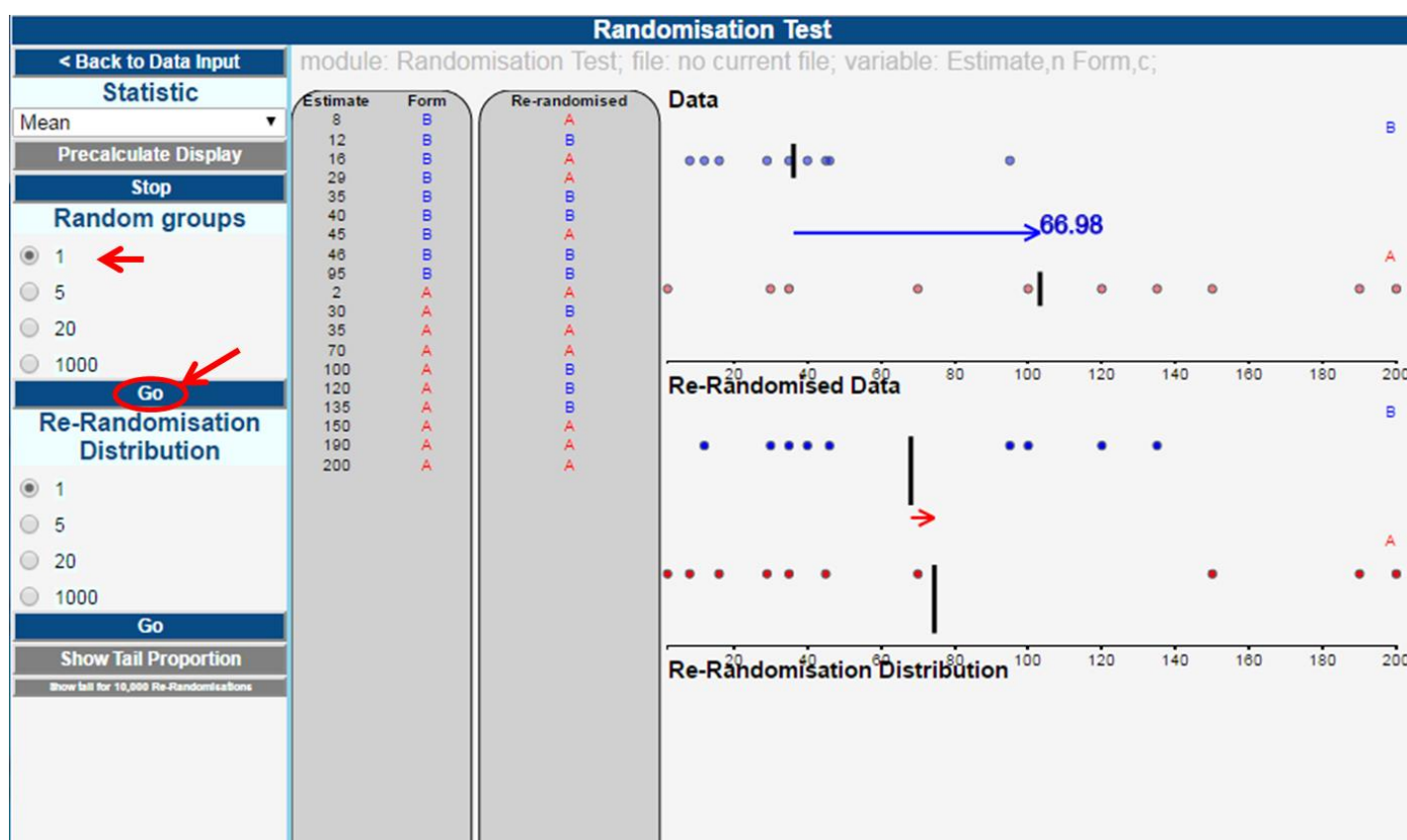
- Under **Statistic**, select **mean** (this is the default)



- Click Precalculate Display

Next, make your selections in the middle part of the window under **Random groups**.

- Select 1 repetition
- Click Go.



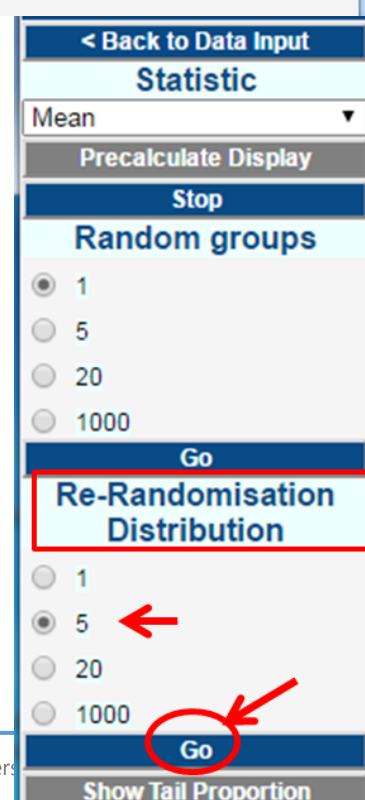
What is happening in the graphics window?

VIT is randomly labelling values as from Group A or Group B regardless of which group the measurement initially came from. This is called re-randomised data. It then calculates the new group means for Groups A and B and calculates the difference between them.

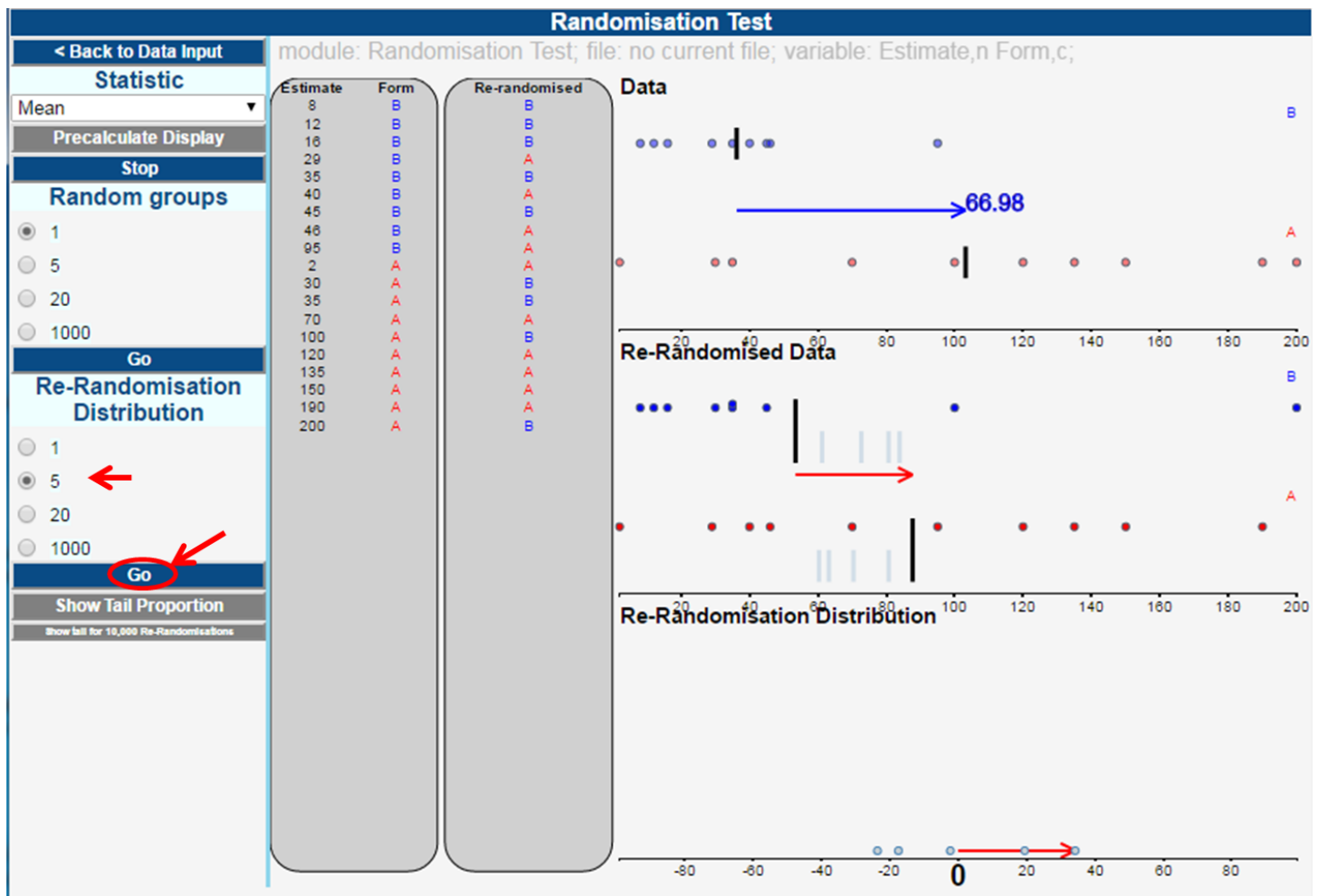
Now we'll use the bottom part of the Analyse window that says **Re-Randomisation Distribution**.

Under Number of repetitions:

- Select 5 repetitions
- Click Go.



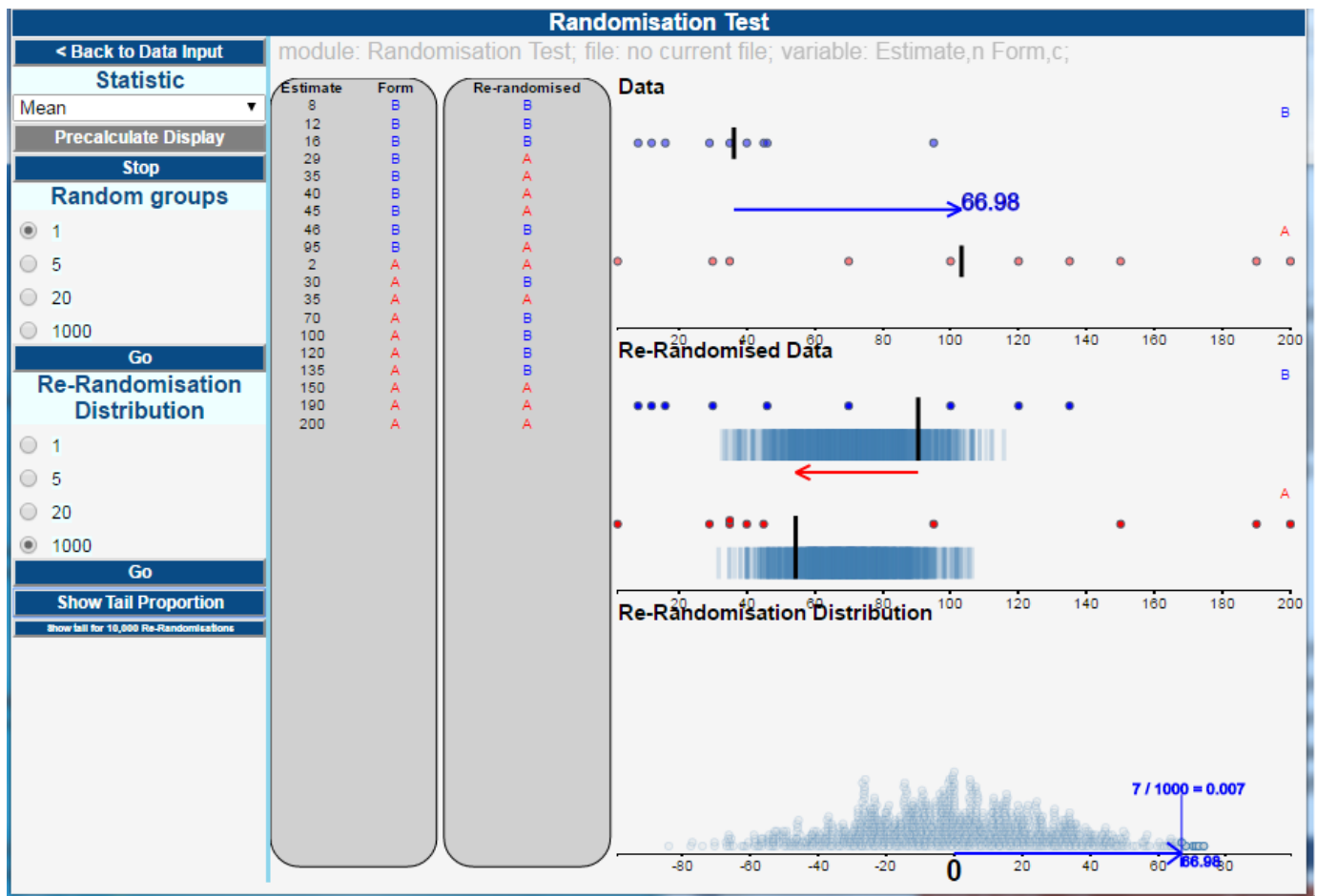
The above process of re-randomising will happen 5 times and each difference between the new randomly assigned groups A and B will now be recorded in the bottom plot called the **Re-Randomisation Distribution**.



In the bottom part of the **analyse** window (**Randomisation distribution**):

- Select 1000 repetitions, click **Go**.
- When that is finished, click **Show tail proportion**.

You will see a **Re-randomisation distribution** of the difference in the Group means of 1000 re-randomisations of the estimates. Each dot in the re-randomisation distribution represents the difference between the group means from one re-randomisation.



What is happening in the graphics window?

The difference (of 66.98 million) between the means of Groups A and B is shown by the blue arrow in the top plot. The difference is then superimposed over the re-randomisation distribution to see how many times out of 1000 re-randomisations we got a difference the same as (or larger than) our experimental difference. In the above example, the difference of 66.98 or larger happened 7 times out of 1000.

Note that your values will probably be slightly different.

EXPLORE (~5 min)

Run your randomisation test another few times and pause it so that you can understand what is happening at each part of the process. **It is important** that you always click **Precalculate Display** between runs. This is when all re-randomisation and the calculations are done. If you don't you'll just keep replaying the same set of results and always get the same answer.

Pressing the bottom button will give the tail proportion from 10,000 re-randomisations (the picture of the distribution won't change). This gives more stable answers.

Do you think there was an "anchoring" effect? Post a comment.

Common questions

Why do the data change their group allocation?

VIT is randomly (and artificially) relabelling the population estimates the people have made as belonging to Groups "A" and "B" to try to see how the experimental results compare to what random allocation acting alone could do. It strips the real group labels away from the estimate (all dots turn black) and randomly re-allocates group labels to the population estimates (dots re-coloured). Then VIT measures the new difference in means between the new artificially formed groups. This is one re-randomisation.

Why is the tail proportion of my plot different from the example?

The re-randomisation process is different every time VIT runs it because it randomly re-allocates the estimates to groups. You should get a tail proportion that is fairly similar. If we ran it a much larger number of times (say 100,000) we would always get the same answer. (The only reason we don't do 100,000 is because plotting would be too slow.)

What does a small tail proportion mean?

The smaller the tail proportion, the less likely it is that the "luck of the draw" would produce a difference this big. A small tail proportion tells us that our experimental results are out in the tails of the randomisation distribution, so that random reallocation almost always gives differences that are smaller than what we got in our experiment.

What does a larger tail proportion mean?

It tells us that random re-allocation often produces a difference larger than we got in our experiment. Our experimental results therefore give no evidence a true treatment difference exists.