Distributions and samples

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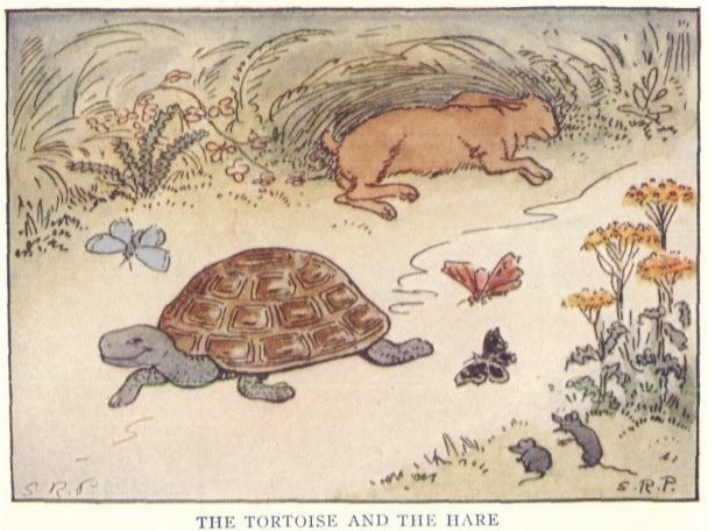
Animal racing!

Your group will need:

- One toy animal *each.*
- Four dice *per group.*
- One 30cm rule *per group.*
- One “start” and one “end” marker *per group.*
- One histogram handout *per group*.



20 min activity

https://commons.wikimedia.org/wiki/File:The_Tortoise_and_the_Hare_-_Project_Gutenberg_etext_19993.jpg

How to play

1) Put the **start marker** at one end of the table.
2) Measure 60cm from that and place your **end marker**.
3) Put your toy animals on the starting line.
4) On your turn:
    1) Roll four dice, add up the score.
    2) Move your animal forward that many centimetres.
    3) Record you score **on Mentimeter.**
5) First person past the line wins!

Details, details...

- Put the front of the animal at the front of the start line.
- Measure your distance from the front of the animal.
- If your animal accidentally gets knocked, put it back.

Question

Is any number on one dice more likely than any other?

https://upload.wikimedia.org/wikipedia/commons/2/2d/D3_Pipped.png

Distribution on a single dice

1 : IIIIIIII

2 : IIIIIII

3 : IIIIIIIIII

4 : IIIIIII

5 : IIIIIIII

6 : IIIIIIIII

Does the **mentimeter** distribution look like this?

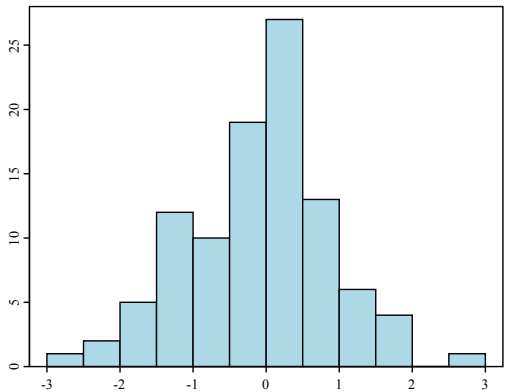
Why / why not?

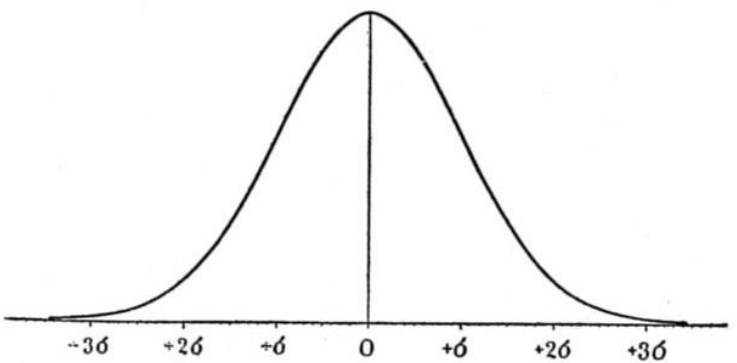
Central Limit Theorem

If a total score is the sum of a bunch of different scores, it will have approximately the same distribution **whatever the distribution of the individual scores.**

A *theorem,* not a *theory**.***

Known as a *normal* or *Gaussian* distribution.

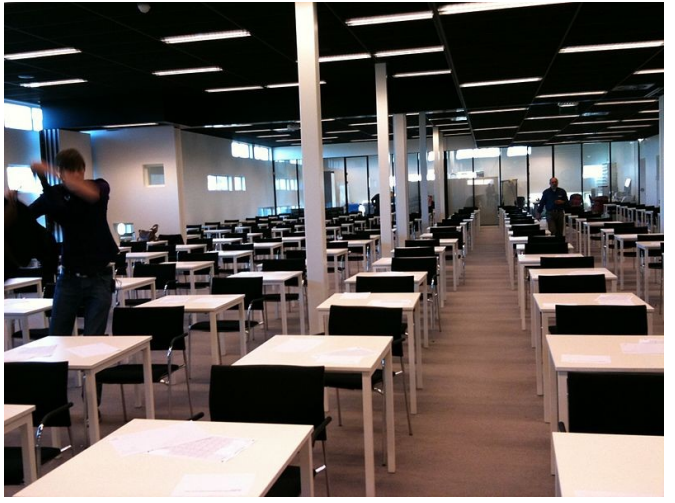




https://commons.wikimedia.org/wiki/File:Histogram_example.svg
https://commons.wikimedia.org/wiki/Category:Normal_distribution#/media/File:Critique_of_the_Theory_of_Evolution_Fig_074.jpg

Exam hall bingo!

- Two groups of the students, the **blues** and the **pinks,** take an exam.
- I'll show you one exam score at a time.
- Without a calculator and without pen and paper, try to work out which group scores higher on exams, on average, **and enter your answer into Mentimeter**.
- *Do this as quickly as possible,* BUT
- **Don't stop until you are sure you have the right answer.**



10 min activity

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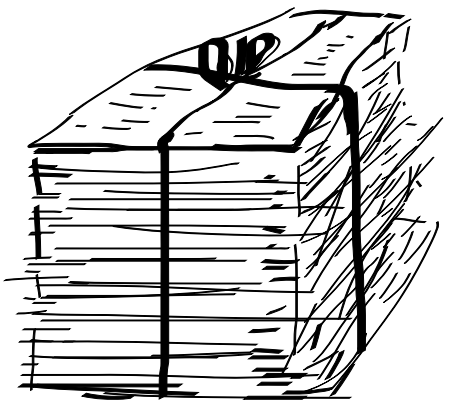
The Results

To be revealed in class…

https://commons.wikimedia.org/wiki/File:Tokyo_University_Entrance_Exam_Results_8.JPG

Sample sizes

- This demonstration is much like a psychology experiment:
  - You collect some data about two groups.
  - You collect enough of it to be confident that you know whether the groups differ.
- To be revealed in class…
  - What the minimum sample size a psychologist should accept for these two groups is.
- To be revealed next ***year***:
  - How I worked out the minimum sample size.



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