Week 8:
Random variables & Sampling

Samira & Sophie, 2023

Adapted from Elena & Willa, 2020

Today's agenda

- Warm-up
- Random variables and distributions
- Sampling distributions

Random variables

So far, we have focused on directly assigning values to variables.

```
num <- 1

df <- penguins.csv

names <- c("Willa", "Elena", "Roya")
```

Random variables

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What is a random variable?

Random variables

“ A variable that takes on different numerical values as a result of a random experiment (eg. flipping a coin) or random measurements (eg. randomly sampling height in the population). “

→ i.e., a way to map outcome of random processes to numbers

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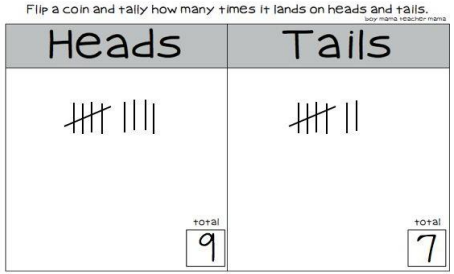
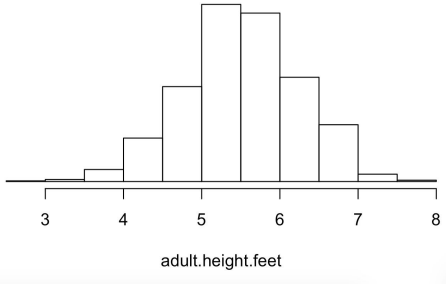
Randomly tossing a coin



Randomly sampling height in a population



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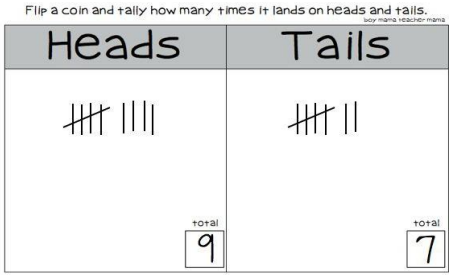


$X = \begin{cases} 1 \text{ if heads} \\ 0 \text{ if tails} \end{cases}$

P(X=1) for a fair coin?

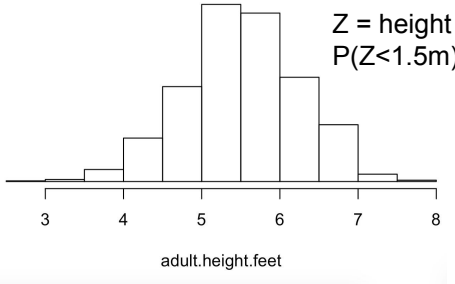
Y = number of heads in 10 coin tosses

P(Y≥8) for a fair coin?

Randomly sampling height in a population

Z = height of a random person

P(Z<1.5m)?



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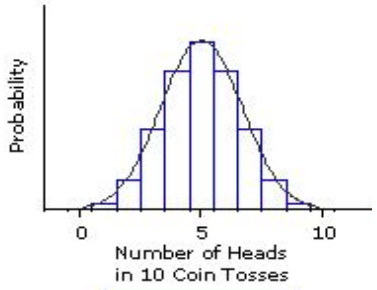

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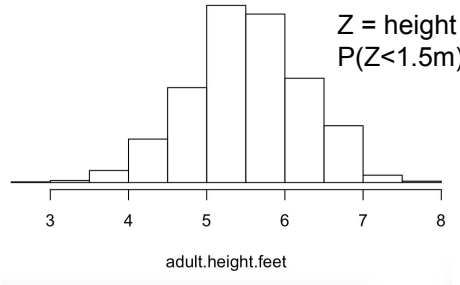

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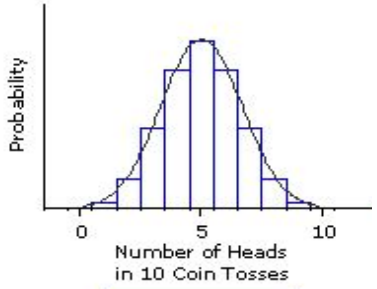

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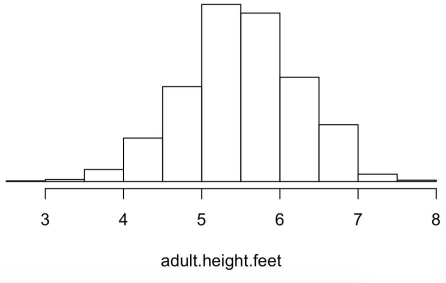

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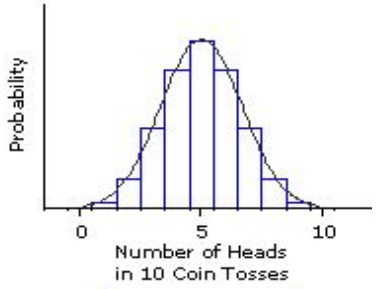

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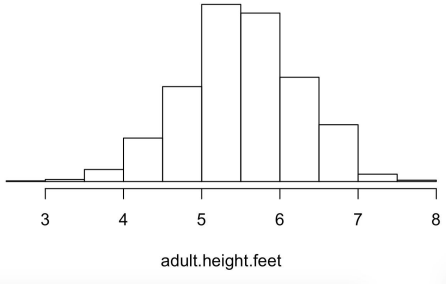

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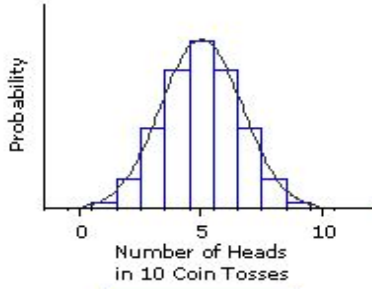

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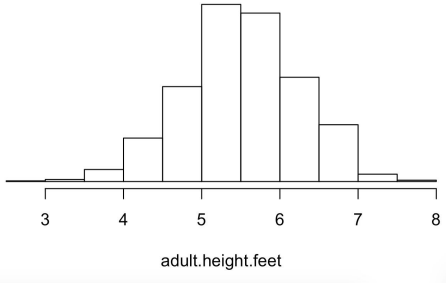

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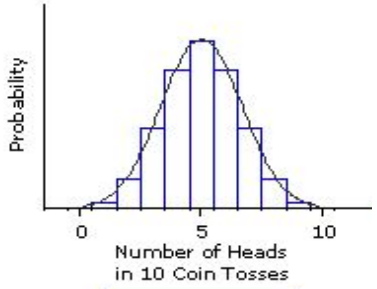

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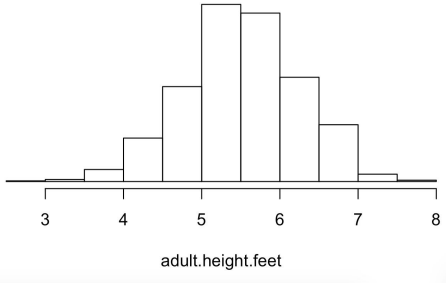

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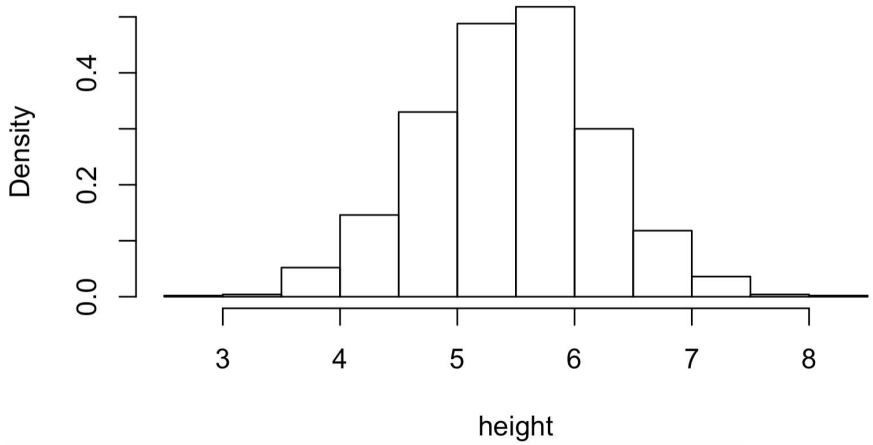
Understanding the definition & properties of random variables becomes important when you are doing data analysis.

How do we define a random variable ?



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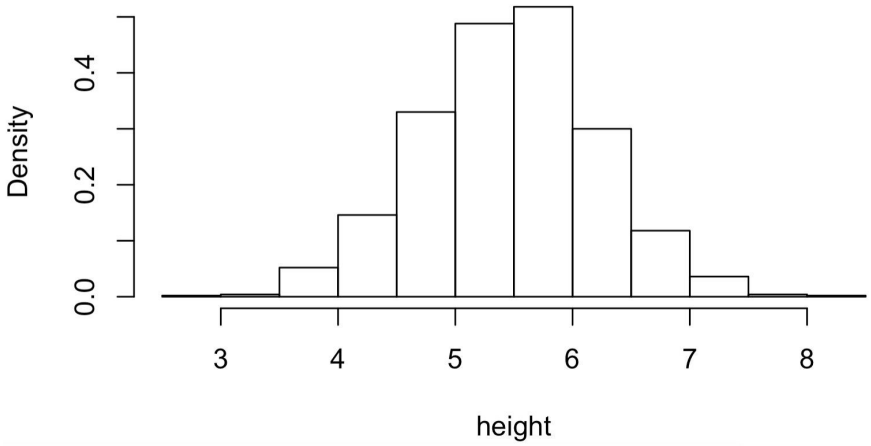

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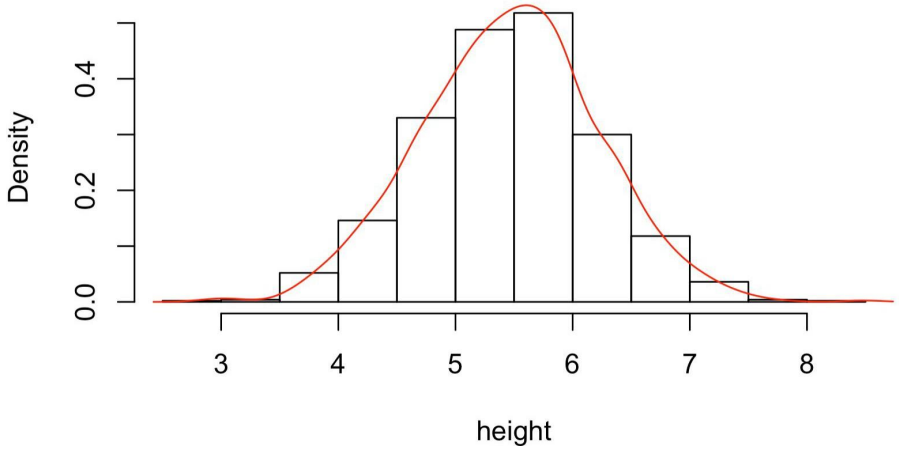

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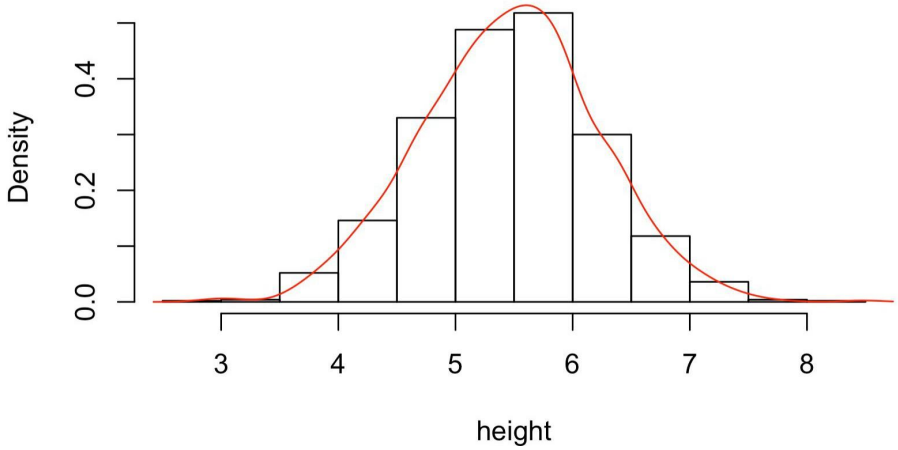

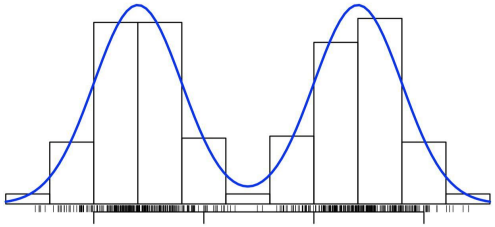

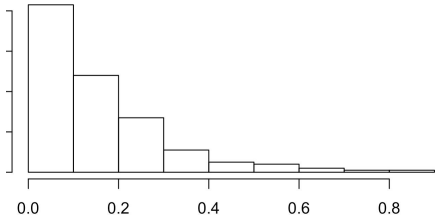

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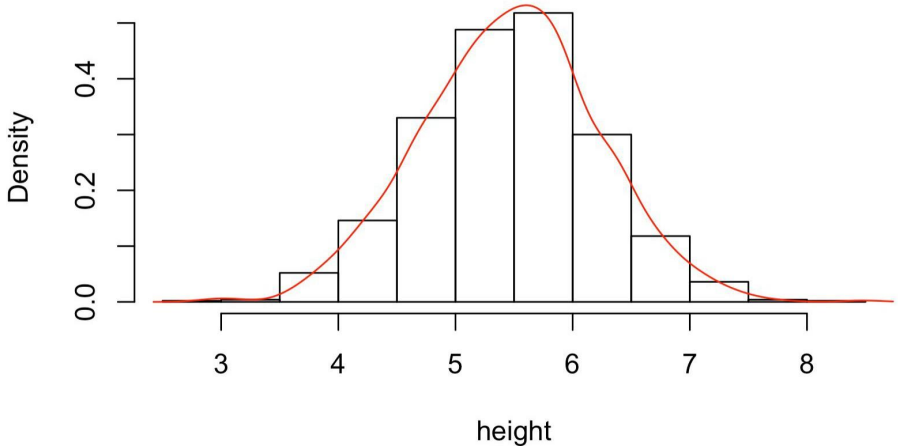

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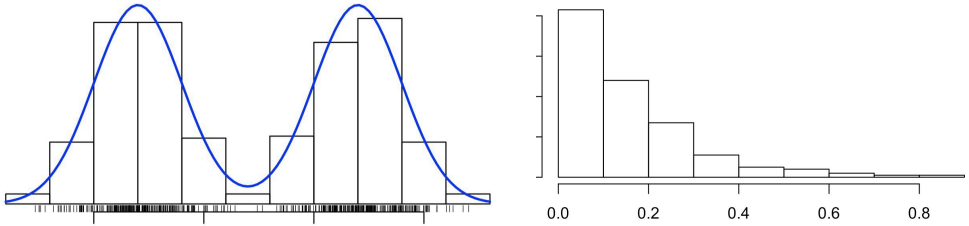

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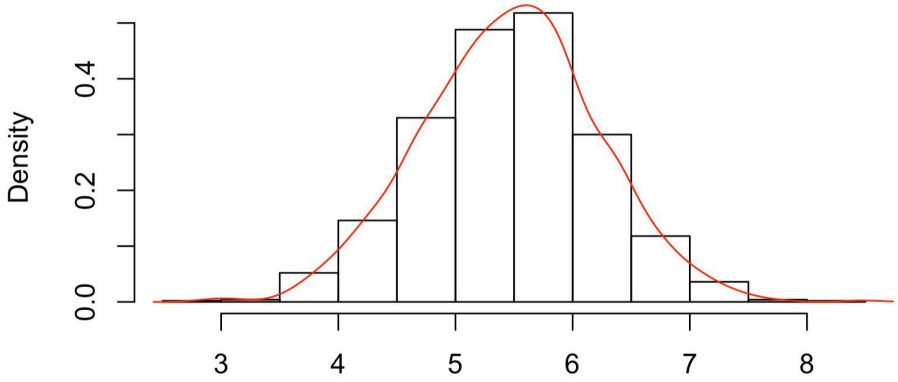

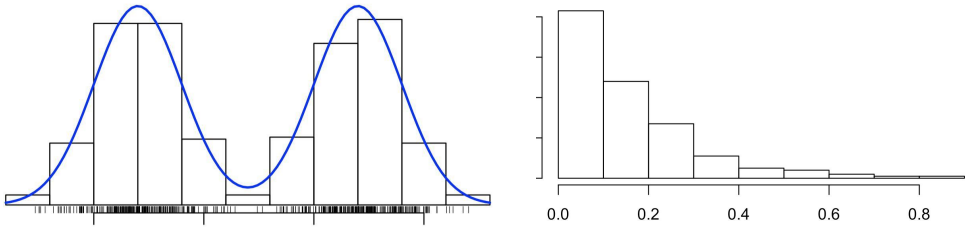

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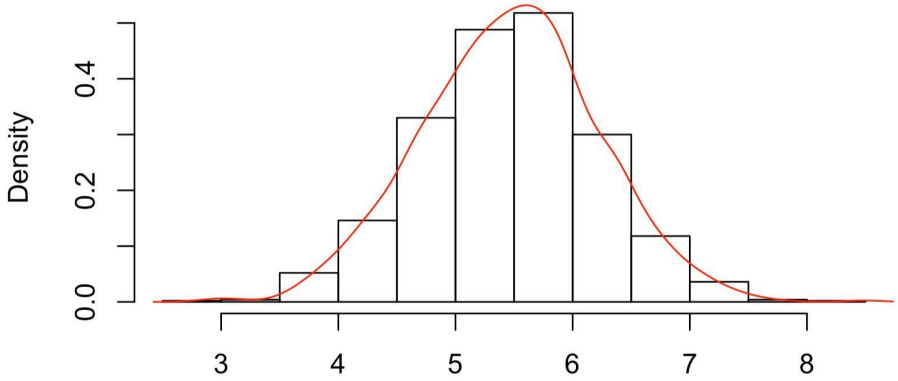

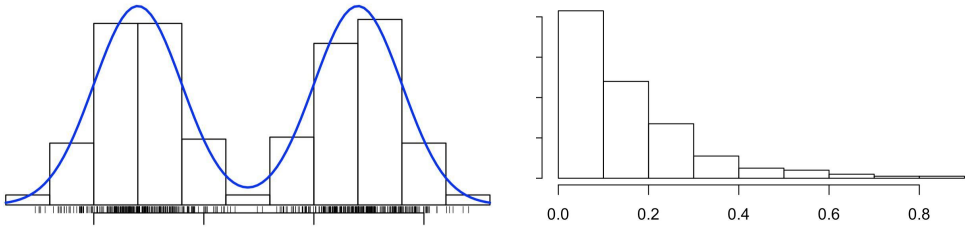

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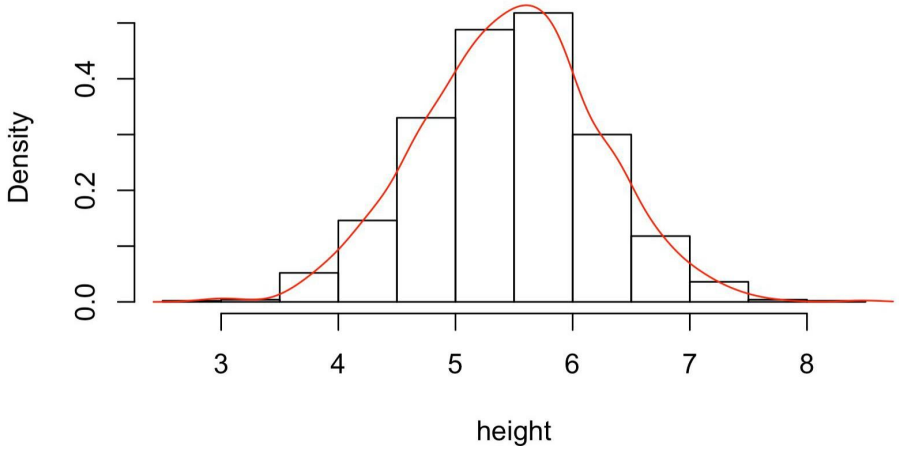

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Thinking about your data this way can help make a lot of statistical techniques more intuitive!

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Simulating observations from a random variable

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Then we will look at the range of values we can get from this variable.