FINDING THE MEDIAN

Which way to the median?

Data or a distribution first; for a distribution, discrete or continuous decides the method.

START

What is given?

sample data

Is the sample size n odd? **yes**

The middle value

sort, then take $x_{(n+1)/2}$

→ How to find the median

{3, 7, 1, 9, 5} → sorted {1, 3, 5, 7, 9} → 5

Is the sample size n odd? **no**

Average the two middle values

sort, then take $(x_{n/2} + x_{n/2+1})/2$

→ How to find the median

{3, 7, 1, 9} → (3 + 7)/2 = 5

a distribution

Discrete or continuous? **discrete**

First k with F(k) ≥ 0.5

check both P(X ≤ k) ≥ 0.5 and P(X ≥ k) ≥ 0.5

→ Discrete distributions

binomial, n = 10, p = 0.5 → median 5

Discrete or continuous? **continuous** · Symmetric? **yes**

The centre of symmetry

no calculation needed

→ Continuous distributions

normal with mean μ → median μ

Discrete or continuous? **continuous** · Symmetric? **no** · Can F(m) = 0.5 be solved by algebra? **yes**

Solve F(m) = 0.5

use the inverse CDF: m = $F^{-1}(0.5)$

→ Continuous distributions

exponential with rate λ → m = ln(2)/λ

Discrete or continuous? **continuous** · Symmetric? **no** · Can F(m) = 0.5 be solved by algebra? **no**

Find the root numerically

bisection, Newton–Raphson, or a software quantile function

→ Continuous distributions