

# Shiny

## Lecture 18

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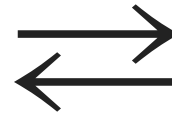
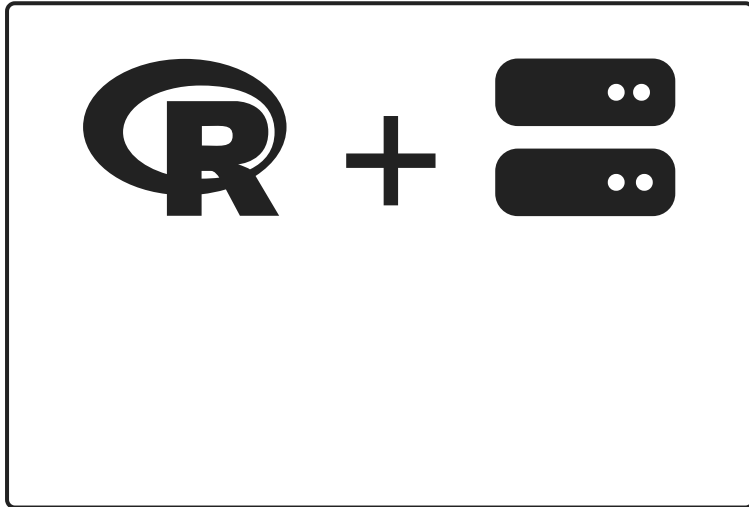


# Shiny

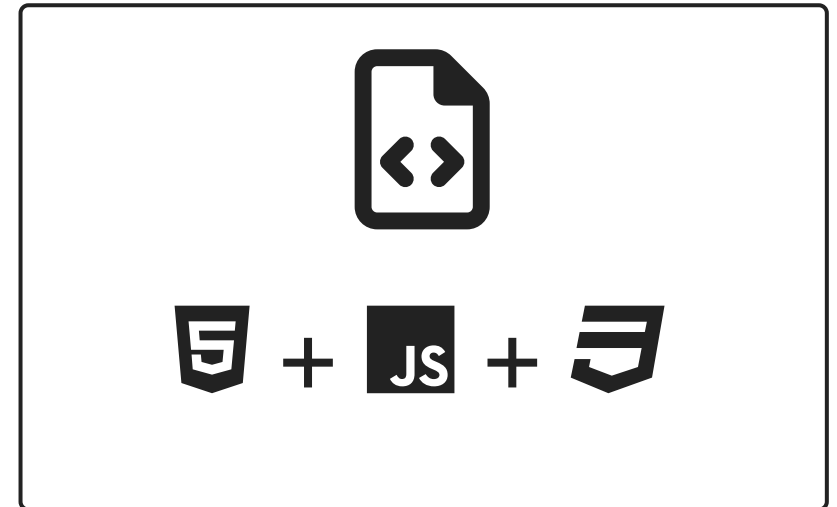
Shiny is an R package that makes it easy to build interactive web apps straight from R. You can host standalone apps on a webpage or embed them in R Markdown documents or build dashboards. You can also extend your Shiny apps with CSS themes, htmlwidgets, and JavaScript actions.

# Shiny App

Server



Client / Browser



# Anatomy of an App

```
1 library(shiny)
2
3 shinyApp(
4   ui = list(),
5
6   server = function(input, output, session) {
7
8   }
9 )
```

# App background

I've brought a coin with me to class and I'm claiming that it is fair (equally likely to come up heads or tails).

I flip the coin 10 times and we observe 7 heads and 3 tails, should you believe me that the coin is fair? Or more generally what should you believe about the coin's fairness now?

# Model

Let  $y$  be the number of successes (heads) in  $n$  trials then,

**Likelihood:**

$$\begin{aligned}y|n, p &\sim \text{Binom}(n, p) \\f(y|n, p) &= \binom{n}{y} p^y (1 - p)^{n-y} \\&= \frac{n!}{y!(n - y)!} p^y (1 - p)^{n-y}\end{aligned}$$

**Prior:**

$$\begin{aligned}p &\sim \text{Beta}(a, b) \\\pi(p|a, b) &= \frac{\Gamma(a + b)}{\Gamma(a)\Gamma(b)} p^{a-1} (1 - p)^{b-1}\end{aligned}$$

# Posterior

From the definition of Bayes' rule:

$$\begin{aligned} f(p|y, n, a, b) &= \frac{f(y|n, p)}{\int_{-\infty}^{\infty} f(y|n, p) dp} \pi(p|a, b) \\ &\propto f(y|n, p) \pi(p|a, b) \end{aligned}$$

We then plug in the likelihood and prior and then simplify by dropping any terms not involving  $p$ ,

$$\begin{aligned} f(p|y, n, a, b) &\propto \left( \frac{n!}{y!(n-y)!} p^y (1-p)^{n-y} \right) \left( \frac{\Gamma(a+b)}{\Gamma(a)\Gamma(b)} p^{a-1} (1-p)^{b-1} \right) \\ &\propto \left( p^y (1-p)^{n-y} \right) \left( p^{a-1} (1-p)^{b-1} \right) \\ &\propto p^{y+a-1} (1-p)^{n-y+b-1} \end{aligned}$$



# Posterior distribution

Based on the form of the density we can see that the posterior of  $p$  must also be a Beta distribution with parameters,

$$p|y, n, a, b \sim \text{Beta}(y + a, n - y + b)$$

