BUILDING WEB APPLICATIONS IN R WITH SHINY: CASE STUDIES

# Introduction

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# Course overview

- Assumes basic Shiny knowledge
- Review important Shiny concepts
- Develop multiple apps for real-life scenarios
- Repetitive practice of essential features to increase familiarity
- Learn new features and best practices

# Shiny app template

```
library(shiny)

ui <- fluidPage()

server <- function(input, output) {}

shinyApp(ui = ui, server = server)
```

1. Load the shiny package
2. Create a webpage with `fluidPage()` — UI of a Shiny app
3. Create server portion of the app — where application logic lives
4. Combine UI + server into a Shiny app and run it

# Adding Text to Shiny

- Add text as argument to `fluidPage()`

```
ui <- fluidPage(
    “Hello there”
)
```

- Result: webpage with text "Hello there"

- `fluidPage()` accepts arbitrary # of arguments

```
ui <- fluidPage(
    “Hello”,
    “there”
)
```

# Formatted Text

| | |
|---|---|
| `h1()` | **Primary header** |
| `h2()` | Secondary header |
| `strong()` | **Bold** |
| `em()` | *Italicized* (*em*phasized) |

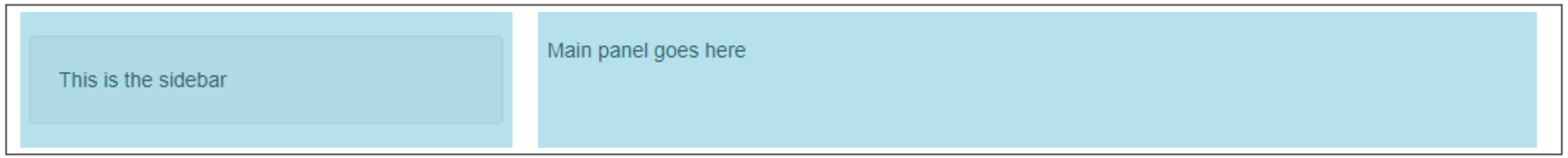
# Formatted text

```
ui <- fluidPage(
    h1("SHINY COURSE"),
    "by",
    strong("Dean Attali"),
)
```

## SHINY COURSE

by **Dean Attali**

# Sidebar Layout




```
ui <- fluidPage(
    sidebarLayout(
        sidebarPanel(
            "This is the sidebar"
        ),
        mainPanel(
            "Main panel goes here"
        )
    )
)
```

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# Let’s practice!

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# Inputs and outputs

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# Inputs

## Text input

**Enter your name**

Dean

## Numeric input

**How many siblings?**

4

# Inputs

**Button**

Action

actionButton()

**Single checkbox**

Choice A

checkboxInput()

**Checkbox group**

Choice 1
Choice 2
Choice 3

checkboxGroupInput()

**Date input**

2014-01-01

dateInput()

**Colour input**

#52CC4E

colourpicker::colourInput()

**Date range**

2014-01-24 to 2014-01-24

dateRangeInput()

**File input**

Choose File No file chosen

fileInput()

**Numeric input**

1

numericInput()

**Password Input**

••••••••••

passwordInput()

**Text area**

Multiple lines
of text

textAreaInput()

**Radio buttons**

Choice 1
Choice 2
Choice 3

radioButtons()

**Select box**

Choice 1

selectInput()

**Sliders**

0 50 100
0 25 75 100

sliderInput()

**Text input**

Enter text...

textInput()

# Building inputs

```
ui <- fluidPage(
    textInput(inputId = “name”, label = “Enter your name”,
              value = “Dean”),
    numericInput(inputId = “sibs”, label = “How many siblings?”,
                 value = 4, min = 0)
)
```

- Input functions: `*Input(inputId, label, ...)`
- `inputId` = Unique ID
- `label` = Text to describe input
- `...` = Additional input-specific parameters

# Outputs

- Plots, tables, text - anything R creates & users see
- Two steps:

1. Create placeholder for output (in UI)

```
ui <- fluidPage(
    “Plot goes here:”,
    plotOutput(outputId = “my_plot”)
)
```

2. Write R code to generate output (in server)

# The server

```
server <- function(input, output) {

  # Code for building outputs

}
```

- `input`
  Read values from here (inputs user modifies)
- `output`
  Write values to here (outputs e.g. plots, tables)

# Building outputs

```
ui <- fluidPage(
    numericInput("num", "Number of rows", value = 10, min = 0),
    tableOutput("my_table")
)

server <- function(input, output) {
    output$my_table <- renderTable({
        head(iris, n = input$num)
    })
}
```

3 Rules to build output object:

1. Build object inside render function (`renderPlot()`, `renderText()`, etc)
2. Save object to `output$<outputId>`
3. Use `input$<inputId>` to access value of input

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# Reactivity 101

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# Reactivity basics

- Shiny uses **reactive programming**
- Outputs **react** to changes in input
- When value of variable `x` changes, anything that relies on `x` is re-evaluated
- Contrast with regular R:

```
> x <- 5
> y <- x + 1
> x <- 10
```

```
> # What is the value of y? 6 or 11?
```

# Reactive variables

- All inputs are reactive
- `input$<inputId>` inside render function will cause output to re-render

```
output$my_plot <- renderPlot({
    plot(rnorm( input$num ))
})
```

- `output$my_plot` depends on `input$num`
  - `input$num` changes ⇒

    `output$my_plot` reacts

# Reactive contexts

- Reactive values can only be used inside **reactive contexts**
- Any `render*()` function is a reactive context
- Accessing reactive value outside of reactive context ⇒ error

```
server <- function(input, output) {
    print(input$num)
}
```

```
ERROR: Operation not allowed without an active reactive context.
```

# Observe a reactive variable

- `observe({ ... })` to access reactive variable

```
server <- function(input, output) {
    observe({
        print( input$num )
    })
}
```

- Useful for debugging, track reactive variable
- Each reactive variable creates a dependency

```
observe({
    print( input$num1 )
    print( input$num2 )
})
```

# Create a reactive variable

- `reactive({ ... })` to create reactive variable
- Wrong:

```
server <- function(input, output) {
    x <- input$num + 1
}
```

```
ERROR: Operation not allowed without an active reactive context.
```

- Correct:

```
server <- function(input, output) {
    x <- reactive({
        input$num + 1
    })
}
```

# Reactive variables

- Access custom reactive variable like a function: add parentheses ( )

```
server <- function(input, output){
    x <- reactive({
        input$num + 1
    })

    observe({
        print( input$num )
        print( x() )
    })
}
```

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# Let’s practice!