# Web apps in R with Shiny

2021-10-23

# apps/goog-index/app.R

# Web apps in R

## Reactivity

# Web apps in R


## Reactivity

## Design and User Interface (UI)

# Web apps in R


Reactivity

Design and User Interface (UI)

**Dashboards**

# Your Turn 1

## Open a new Shiny file (file > New File > Shiny Web App)

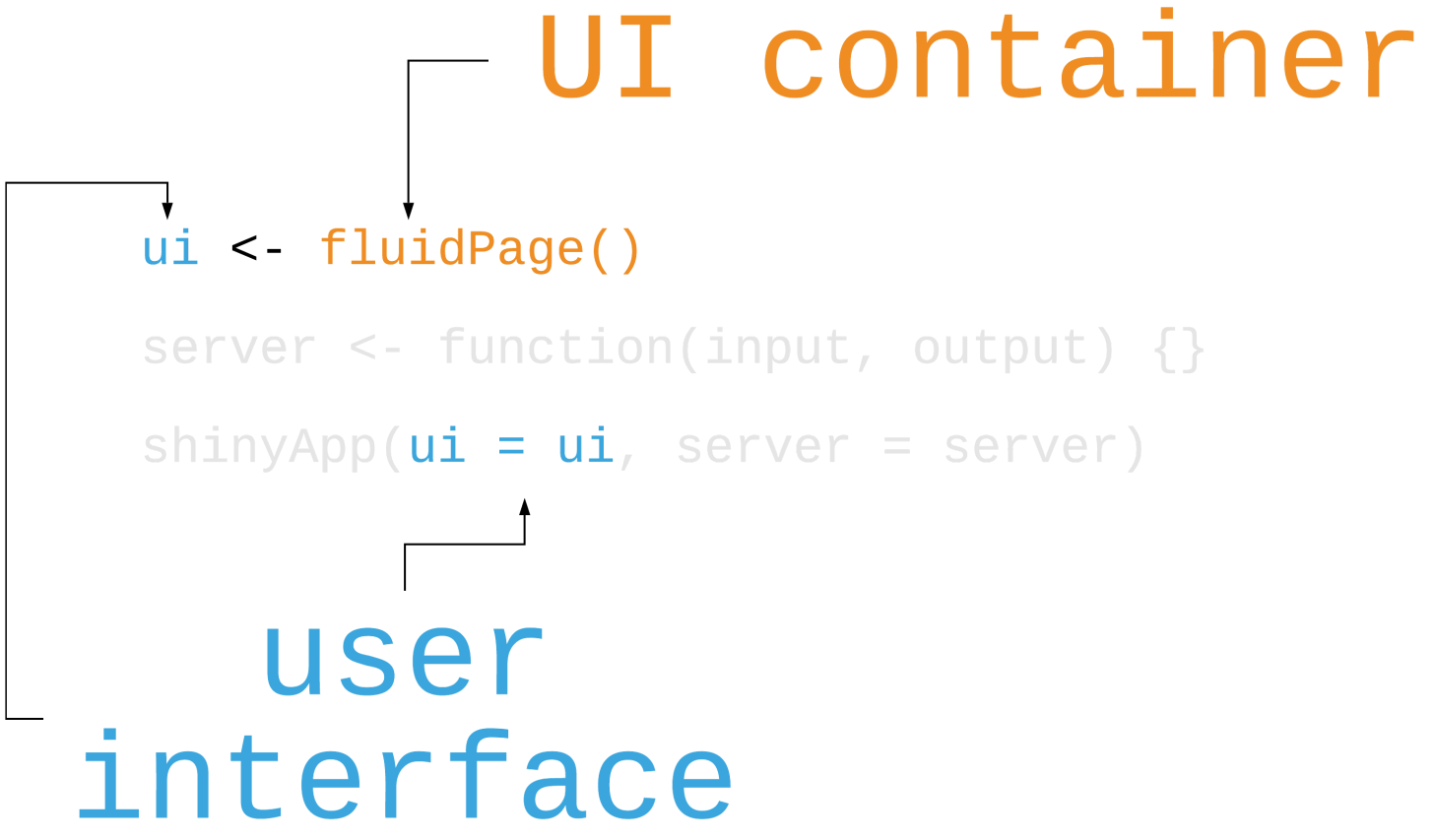
## Run the app

## Stop the app from running

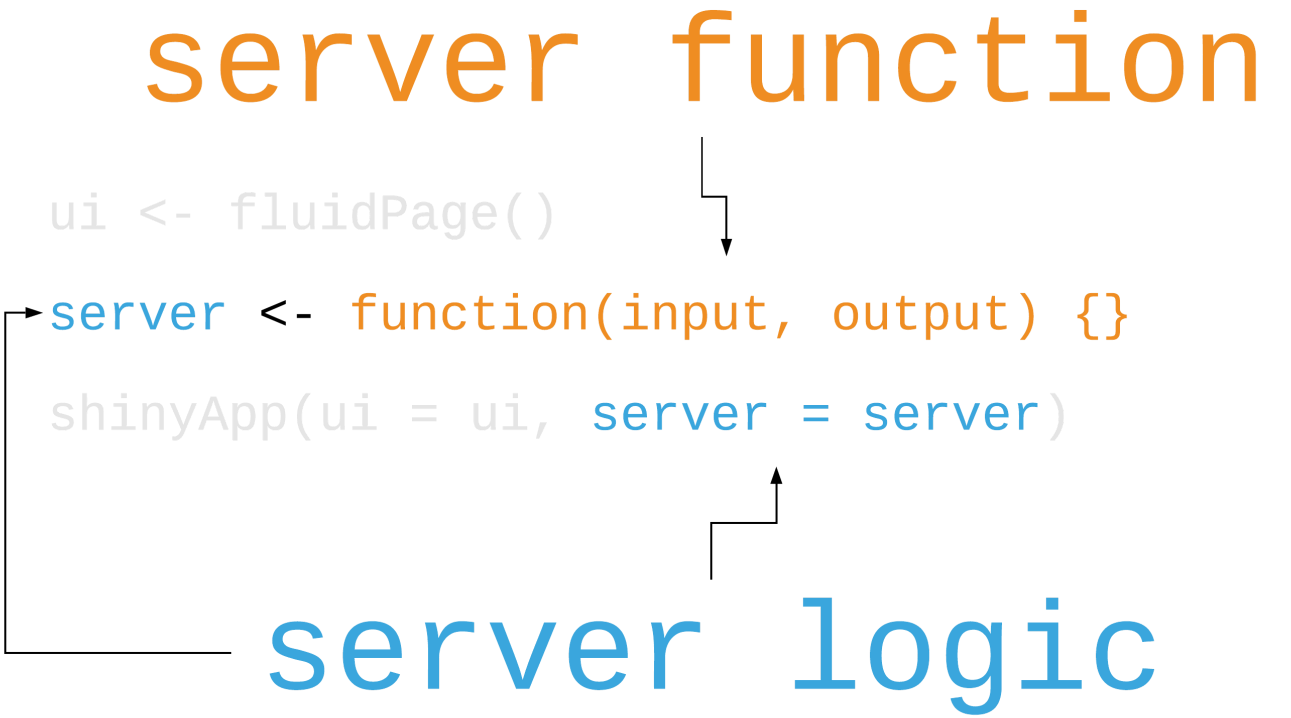
# Anatomy of a shiny app

```
ui <- fluidPage()

server <- function(input, output) {}

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

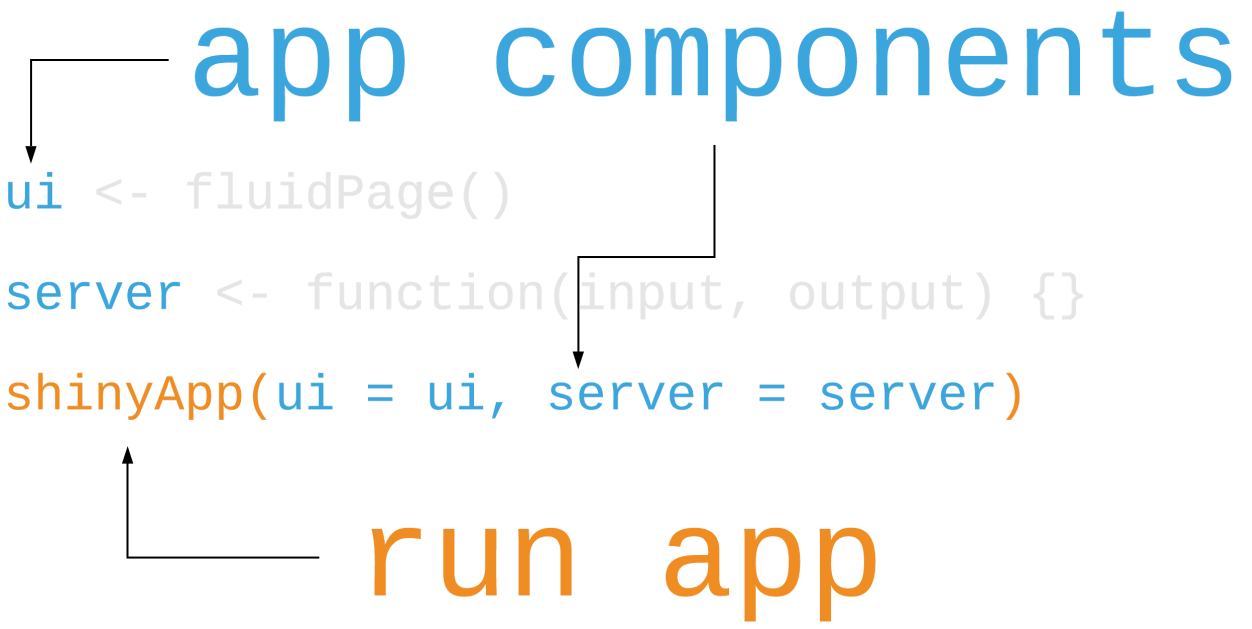
# Anatomy of a shiny app



# Anatomy of a shiny app



# Anatomy of a shiny app



# new data alert!

## movies

| | title | title_type | genre | runtime | mpaa_rating | stud |
|---|---|---|---|---|---|---|
| 1 | Filly Brown | Feature Film | Drama | 80 | R | Indo |
| 2 | The Dish | Feature Film | Drama | 101 | PG-13 | Warr |
| 3 | Waiting for Guffman | Feature Film | Comedy | 84 | R | Sony |
| 4 | The Age of Innocence | Feature Film | Drama | 139 | PG | Colu |
| 5 | Malevolence | Feature Film | Horror | 90 | R | Anch |
| 6 | Old Partner | Documentary | Documentary | 78 | Unrated | Shca |
| 7 | Lady Jane | Feature Film | Drama | 142 | PG-13 | Para |
| 8 | Mad Dog Time | Feature Film | Drama | 93 | R | MGM |
| 9 | Beauty Is Embarrassing | Documentary | Documentary | 88 | Unrated | Inde |
| 10 | The Snowtown Murders | Feature Film | Drama | 119 | Unrated | IFC F |
| 11 | Superman II | Feature Film | Action & Adventure | 127 | PG | Warr |
| 12 | Leap of Faith | Feature Film | Drama | 108 | PG-13 | Para |
| 13 | The Royal Tenenbaums | Feature Film | Comedy | 110 | R | Buer |
| 14 | School for Scoundrels | Feature Film | Comedy | 100 | PG-13 | MGM |
| 15 | Rhinestone | Feature Film | Comedy | 111 | PG | 20th |
| 16 | Burn After Reading | Feature Film | Drama | 96 | R | Focu |
| 17 | The Doors | Feature Film | Drama | 140 | R | Sony |
| 18 | The Wood | Feature Film | Drama | 106 | R | Para |
| 19 | Jason X | Feature Film | Horror | 91 | R | New |
| 20 | Dragon Wars | Feature Film | Drama | 90 | PG-13 | Sony |
| 21 | Fallen | Feature Film | Drama | 124 | R | Warr |
| 22 | The Gleaners and I | Documentary | Documentary | 82 | Unrated | Zeitg |

### Where does it come from?

```
movies.Rdata
```

### How can I use it?

```
load("movies.Rdata")
View(movies)
```

*this loads it in your global environment*

## Your Turn 2

**Open** apps/movies_01.R

**Try to identify the components of the app**

**Run the app**

**Stop the app**

# movies_01.R

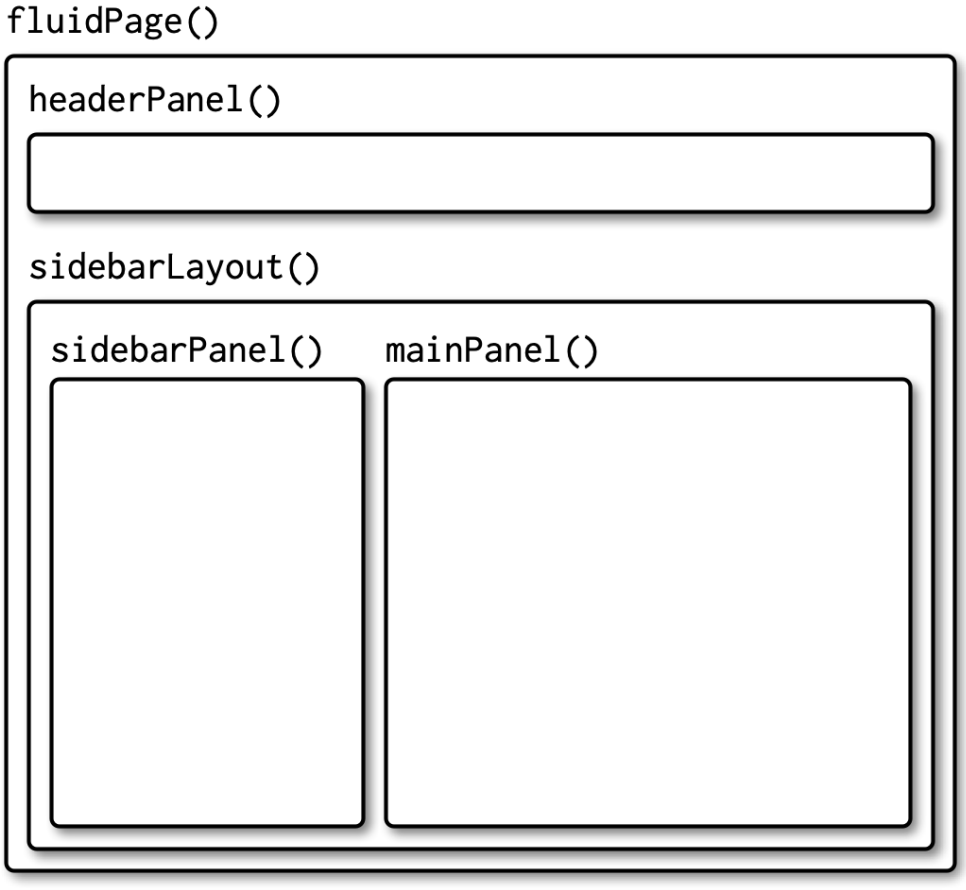



Image by Hadley Wickham

# Sidebar layouts

```
ui <- fluidPage(
  headerPanel(),
  sidebarLayout(
    sidebarPanel(
      # Inputs
    ),
    mainPanel(
      # Outputs
    )
  )
)
```

# Sidebar inputs

```
sidebarPanel(
  selectInput(
    inputId = "y",
    label = "Y-axis:",
    choices = c("..."),
    selected = "audience_score"
  ),
  selectInput(
    inputId = "x",
    label = "X-axis:",
    choices = c("..."),
    selected = "critics_score"
  )
)
```

# Sidebar inputs

```
sidebarPanel(
  selectInput(
    inputId = "y",
    label = "Y-axis:",
    choices = c("..."),
    selected = "audience_score"
  ),
  selectInput(
    inputId = "x",
    label = "X-axis:",
    choices = c("..."),
    selected = "critics_score"
  )
)
```

# Sidebar inputs

```
sidebarPanel(
  selectInput(
    inputId = "y",
    label = "Y-axis:",
    choices = c("..."),
    selected = "audience_score"
  ),
  selectInput(
    inputId = "x",
    label = "X-axis:",
    choices = c("..."),
    selected = "critics_score"
  )
)
```

# Main panel outputs

```
mainPanel(
  plotOutput(outputId = "scatterplot")
)
```

# Main panel outputs

```
mainPanel(
  plotOutput(outputId = "scatterplot")
)
```

# Server

```
server <- function(input, output) {
  output$scatterplot <- renderPlot({
    ggplot(
      data = movies,
      aes_string(x = input$x, y = input$y)
    ) +
      geom_point()
  })
}
```

# Server

```
server <- function(input, output) {
  output$scatterplot <- renderPlot({
    ggplot(
      data = movies,
      aes_string(x = input$x, y = input$y)
    ) +
      geom_point()
  })
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```

# Main panel outputs

```
mainPanel(
  plotOutput(outputId = "scatterplot")
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```

# Server

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    ggplot(
      data = movies,
      aes_string(x = input$x, y = input$y)
    ) +
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  })
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# Server

```
server <- function(input, output) {
  output$scatterplot <- renderPlot({
    ggplot(
      data = movies,
      aes_string(x = input$x, y = input$y)
    ) +
      geom_point()
  })
}
```

# Sidebar inputs

```
sidebarPanel(
  selectInput(
    inputId = "y",
    label = "Y-axis:",
    choices = c("..."),
    selected = "audience_score"
  ),
  selectInput(
    inputId = "x",
    label = "X-axis:",
    choices = c("..."),
    selected = "critics_score"
  )
)
```

# Server

```
server <- function(input, output) {
  output$scatterplot <- renderPlot({
    ggplot(
      data = movies,
      aes_string(x = input$x, y = input$y)
    ) +
      geom_point()
  })
}
```

# Run the app

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

# Your Turn 3

**Add new select menu to color the points. Use the following arguments:** inputId = "z", label = "Color by:", choices = c("title_type", "genre", "mpaa_rating", "critics_rating", "audience_rating"), selected = "mpaa_rating"

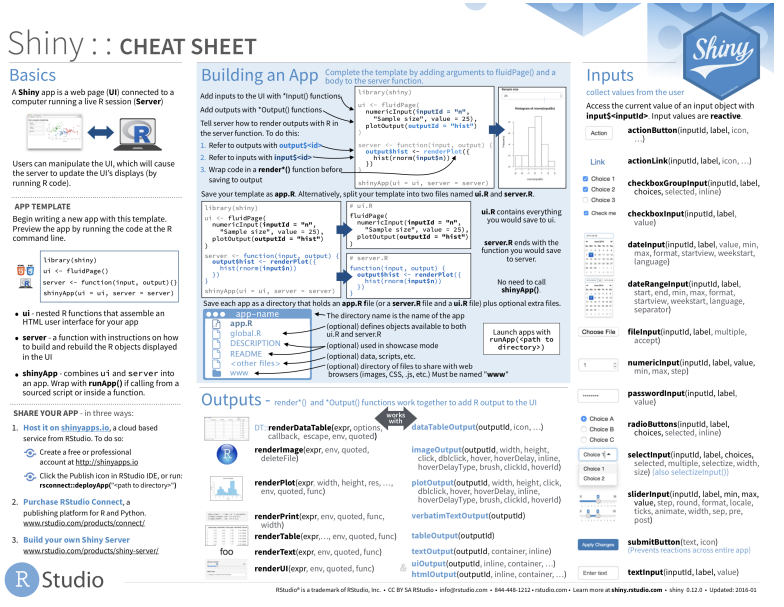
**Use this variable in the aesthetics of the ggplot function as the color argument**

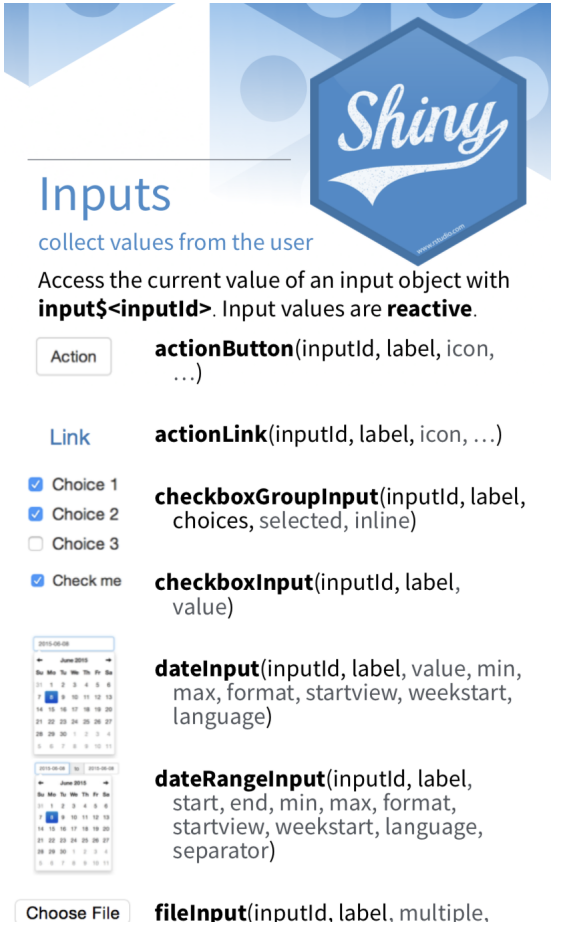
**Run the app in the Viewer Pane**

# Your Turn 3 (solution: movies_02.R)

```
# in sidebarPanel()
selectInput(
  inputId = "z",
  label = "Color by:",
  choices = c("..."), # truncated
  selected = "mpaa_rating"
)
```

```
# in server <- function(input, output) {}
output$scatterplot <- renderPlot({
  ggplot(
    data = movies,
    aes_string(x = input$x, y = input$y, color = input$z)
  ) +
    geom_point()
})
```


Shiny : : CHEAT SHEET
Basics
A Shiny app is a web page (UI) connected to a computer running a live R session (Server)
Users can manipulate the UI, which will cause the server to update the UI's displays (by running R code).
APP TEMPLATE
Begin writing a new app with this template. Preview the app by running the code at the R command line.
library(shiny)
ui <- fluidPage()
server <- function(input, output) {}
shinyApp(ui = ui, server = server)
ui - nested R functions that assemble an HTML user interface for your app
server - a function with instructions on how to build and rebuild the R objects displayed in the UI
shinyApp - combines ui and server into an app. Wrap with runApp() if calling from a sourced script or inside a function.
SHARE YOUR APP - in three ways:
1. Host it on shinyapps.io, a cloud based service from RStudio. To do so:
Create a free or professional account at http://shinyapps.io
Click the Publish icon in RStudio IDE, or run: rsconnect::deployApp("<path to directory>")
2. Purchase RStudio Connect, a publishing platform for R and Python. www.rstudio.com/products/connect/
3. Build your own Shiny Server www.rstudio.com/products/shiny-server/
RStudio
Building an App
Complete the template by adding arguments to fluidPage() and a body to the server function.
Add inputs to the UI with *Input() functions
Add outputs with *Output() functions
Tell server how to render outputs with R in the server function. To do this:
1. Refer to outputs with output$<id>
2. Refer to inputs with input$<id>
3. Wrap code in a render*() function before saving to output
Save your template as app.R. Alternatively, split your template into two files named ui.R and server.R.
ui.R contains everything you would save to ui.
server.R ends with the function you would save to server.
No need to call shinyApp().
Save each app as a directory that holds an app.R file (or a server.R file and a ui.R file) plus optional extra files.
app-name
app.R
global.R
DESCRIPTION
README
<other files>
www
The directory name is the name of the app
(optional) defines objects available to both ui.R and server.R
(optional) used in showcase mode
(optional) data, scripts, etc.
(optional) directory of files to share with web browsers (images, CSS, .js, etc.) Must be named "www"
Launch apps with runApp('<path to directory>')
Outputs - render*() and *Output() functions work together to add R output to the UI
works with
DT::renderDataTable(expr, options, callback, escape, env, quoted)
dataTableOutput(outputId, icon, ...)
renderImage(expr, env, quoted, deleteFile)
imageOutput(outputId, width, height, click, dblclick, hover, hoverDelay, inline, hoverDelayType, brush, clickId, hoverId)
renderPlot(expr, width, height, res, ..., env, quoted, func)
plotOutput(outputId, width, height, click, dblclick, hover, hoverDelay, inline, hoverDelayType, brush, clickId, hoverId)
renderPrint(expr, env, quoted, func, width)
verbatimTextOutput(outputId)
renderTable(expr, ..., env, quoted, func)
tableOutput(outputId)
foo
renderText(expr, env, quoted, func)
textOutput(outputId, container, inline)
renderUI(expr, env, quoted, func)
uiOutput(outputId, inline, container, ...)
htmlOutput(outputId, inline, container, ...)
Inputs
collect values from the user
Access the current value of an input object with input$<inputId>. Input values are reactive.
actionButton(inputId, label, icon, ...)
actionLink(inputId, label, icon, ...)
checkboxGroupInput(inputId, label, choices, selected, inline)
checkboxInput(inputId, label, value)
dateInput(inputId, label, value, min, max, format, startview, weekstart, language)
dateRangeInput(inputId, label, start, end, min, max, format, startview, weekstart, language, separator)
fileInput(inputId, label, multiple, accept)
numericInput(inputId, label, value, min, max, step)
passwordInput(inputId, label, value)
radioButtons(inputId, label, choices, selected, inline)
selectInput(inputId, label, choices, selected, multiple, selectize, width, size) (also selectizeInput())
sliderInput(inputId, label, min, max, value, step, round, format, locale, ticks, animate, width, sep, pre, post)
submitButton(text, icon) (Prevents reactions across entire app)
textInput(inputId, label, value)
RStudio® is a trademark of RStudio, Inc. • CC BY SA RStudio • info@rstudio.com • 844-448-1212 • rstudio.com • Learn more at shiny.rstudio.com • shiny 0.12.0 • Updated: 2016-01


Inputs
collect values from the user
Access the current value of an input object with input$<inputId>. Input values are reactive.
Action
actionButton(inputId, label, icon, ...)
Link
actionLink(inputId, label, icon, ...)
Choice 1
Choice 2
Choice 3
checkboxGroupInput(inputId, label, choices, selected, inline)
Check me
checkboxInput(inputId, label, value)
dateInput(inputId, label, value, min, max, format, startview, weekstart, language)
dateRangeInput(inputId, label, start, end, min, max, format, startview, weekstart, language, separator)
Choose File
fileInput(inputId, label, multiple,

# Your Turn 4

**Add a slider input to control the alpha level of the scatterplot points. Don't forget to label it!**

**Set** min **to 0 and** max **to 1. Choose a default for** value

**Use the value from this input in the plot**

**Run the app**

# Your Turn 4 (solution: movies_03.R)

```
# in sidebarPanel()
sliderInput(
  inputId = "alpha",
  label = "Alpha:",
  min = 0,
  max = 1,
  value = 0.5
)
```

```
# in server <- function(input, output) {}
output$scatterplot <- renderPlot({
  ggplot(
    data = movies,
    aes_string(x = input$x, y = input$y, color = input$z)
  ) +
    geom_point(alpha = input$alpha)
})
```

# Shiny : : CHEAT SHEET

## Basics

A **Shiny** app is a web page (**UI**) connected to a computer running a live R session (**Server**)



Users can manipulate the UI, which will cause the server to update the UI's displays (by running R code).

**APP TEMPLATE**

Begin writing a new app with this template. Preview the app by running the code at the R command line.

```
library(shiny)
ui <- fluidPage()
server <- function(input, output){}
shinyApp(ui = ui, server = server)
```

- **ui** - nested R functions that assemble an HTML user interface for your app
- **server** - a function with instructions on how to build and rebuild the R objects displayed in the UI
- **shinyApp** - combines `ui` and `server` into an app. Wrap with **runApp()** if calling from a sourced script or inside a function.

**SHARE YOUR APP** - in three ways:

1. **Host it on shinyapps.io**, a cloud based service from RStudio. To do so:
   - Create a free or professional account at http://shinyapps.io
   - Click the Publish icon in RStudio IDE, or run: **rsconnect::deployApp("<path to directory>")**
2. **Purchase RStudio Connect**, a publishing platform for R and Python. www.rstudio.com/products/connect/
3. **Build your own Shiny Server** www.rstudio.com/products/shiny-server/

RStudio

## Building an App

Complete the template by adding arguments to fluidPage() and a body to the server function.

Add inputs to the UI with *Input() functions

Add outputs with *Output() functions

Tell server how to render outputs with R in the server function. To do this:

1. Refer to outputs with **output$<id>**
2. Refer to inputs with **input$<id>**
3. Wrap code in a **render*()** function before saving to output

```
library(shiny)
ui <- fluidPage(
  numericInput(inputId = "n",
    "Sample size", value = 25),
  plotOutput(outputId = "hist")
)
server <- function(input, output) {
  output$hist <- renderPlot({
    hist(rnorm(input$n))
  })
}
shinyApp(ui = ui, server = server)
```

Save your template as **app.R**. Alternatively, split your template into two files named **ui.R** and **server.R**.

```
# ui.R
fluidPage(
  numericInput(inputId = "n",
    "Sample size", value = 25),
  plotOutput(outputId = "hist")
)
```

**ui.R** contains everything you would save to ui.

```
# server.R
function(input, output) {
  output$hist <- renderPlot({
    hist(rnorm(input$n))
  })
}
```

**server.R** ends with the function you would save to server.

No need to call **shinyApp()**

Save each app as a directory that holds an **app.R** file (or a **server.R** file and a **ui.R** file) plus optional extra files.

```
app-name
  app.R
  global.R
  DESCRIPTION
  README
  <other files>
  www
```

The directory name is the name of the app

(optional) defines objects available to both ui.R and server.R

(optional) used in showcase mode

(optional) data, scripts, etc.

(optional) directory of files to share with web browsers (images, CSS, .js, etc.) Must be named "**www**"

Launch apps with `runApp('<path to directory>')`

## Outputs - render*() and *Output() functions work together to add R output to the UI

works with

DT::**renderDataTable**(expr, options, callback, escape, env, quoted) — **dataTableOutput**(outputId, icon, ...)

**renderImage**(expr, env, quoted, deleteFile) — **imageOutput**(outputId, width, height, click, dblclick, hover, hoverDelay, inline, hoverDelayType, brush, clickId, hoverId)

**renderPlot**(expr, width, height, res, ..., env, quoted, func) — **plotOutput**(outputId, width, height, click, dblclick, hover, hoverDelay, inline, hoverDelayType, brush, clickId, hoverId)

**renderPrint**(expr, env, quoted, func, width) — **verbatimTextOutput**(outputId)

**renderTable**(expr, ..., env, quoted, func) — **tableOutput**(outputId)

**renderText**(expr, env, quoted, func) — **textOutput**(outputId, container, inline)

**renderUI**(expr, env, quoted, func) & **htmlOutput**(outputId, inline, container, ...) — **uiOutput**(outputId, inline, container, ...)

## Inputs

collect values from the user

Access the current value of an input object with **input$<inputId>**. Input values are **reactive**.

**actionButton**(inputId, label, icon, ...)

**actionLink**(inputId, label, icon, ...)

**checkboxGroupInput**(inputId, label, choices, selected, inline)

**checkboxInput**(inputId, label, value)

**dateInput**(inputId, label, value, min, max, format, startview, weekstart, language)

**dateRangeInput**(inputId, label, start, end, min, max, format, startview, weekstart, language, separator)

**fileInput**(inputId, label, multiple, accept)

**numericInput**(inputId, label, value, min, max, step)

**passwordInput**(inputId, label, value)

**radioButtons**(inputId, label, choices, selected, inline)

**selectInput**(inputId, label, choices, selected, multiple, selectize, width, size) (also selectizeInput())

**sliderInput**(inputId, label, min, max, value, step, round, format, locale, ticks, animate, width, sep, pre, post)

**submitButton**(text, icon) (Prevents reactions across entire app)

**textInput**(inputId, label, value)



## Outputs - render*() and *Output() functions work together to add

works with

DT::**renderDataTable**(expr, options, callback, escape, env, quoted) — **dataTableOutpu**

**renderImage**(expr, env, quoted, deleteFile) — **imageOutput**(ou click, dblclick, h hoverDelayTyp

**renderPlot**(expr, width, height, res, ..., env, quoted, func) — **plotOutput**(outp dblclick, hover, hoverDelayTyp

**renderPrint**(expr, env, quoted, func, width) — **verbatimTextOu**

**renderTable**(expr,..., env, quoted, func) — **tableOutput**(out

**renderText**(expr, env, quoted, func) — **textOutput**(outp

**renderUI**(expr, env, quoted, func) & **uiOutput**(output **htmlOutput**(outp

# Your Turn 5

**Add a new output in** server **using** DT::renderDataTable()**. Inside of the render function, create a data table with** DT::datatable()

**Set** data = movies[, 1:7]**,** options = list(pageLength = 10)**, and** rownames = FALSE

**Add the output to** mainPanel() **in** ui **using** DT::dataTableOutput()

**Run the app**

# Your Turn 5 (solution: movies_04.R)

```r
# in mainPanel()
DT::dataTableOutput(outputId = "moviestable")
```

```r
# in server <- function(input, output) {}
output$moviestable <- DT::renderDataTable({
  DT::datatable(
    data = movies[, 1:7],
    options = list(pageLength = 10),
    rownames = FALSE
  )
})
```

# Your Turn 6

**Add a title to your app with** headerPanel()

**Make the input choices nicer by making the vector named, e.g.** choices = c("IMDB rating" = "imdb_rating", ...)

**Clean up your axes titles with:**

str_replace_all() **to replace _ with** " "

str_to_title() **to change to title case**

# Your Turn 6

**str_replace_all()** takes three arguments,

```
str_replace_all(
  string = "lord_of_the_rings",
  pattern = "_",
  replacement = " "
)
```

**str_to_title()** converts the case of a string to title case.

```
str_to_title("lord of the rings")
```

# Your Turn 6 (solution: movies_05.R)

```
# in fluidPage()
headerPanel("Movie browser")
```

```
# in sidebarPanel()
selectInput(
  ...,
  choices = c(
    "IMDB rating" = "imdb_rating",
    "IMDB number of votes" = "imdb_num_votes",
    "Critics Score" = "critics_score",
    "Audience Score" = "audience_score",
    "Runtime" = "runtime"
  )
)
```

# Your Turn 6 (solution: movies_05.R)

```
# in server <- function(input, output) {}
output$scatterplot <- renderPlot({
  ggplot(
    data = movies,
    aes_string(x = input$x, y = input$y, color = input$z)
  ) +
    geom_point(alpha = input$alpha) +
    labs(
      x = str_to_title(str_replace_all(input$x, "_", " ")),
      y = str_to_title(str_replace_all(input$y, "_", " ")),
      color = str_to_title(str_replace_all(input$z, "_", " "))
    )
})
```

# Directory Structure

```
|--name_of_app
    |-- app.R
```

```
|--name_of_app
    |-- ui.R
    |-- server.R
    |-- global.R
    |-- www
        |-- image.png
```

# Sharing your app

# Sharing your app

## shinyapps.io

# Sharing your app

shinyapps.io

**Shiny Server**

# Sharing your app

shinyapps.io

Shiny Server

**RStudio Connect or Shiny Server Pro**

## Your Turn 7

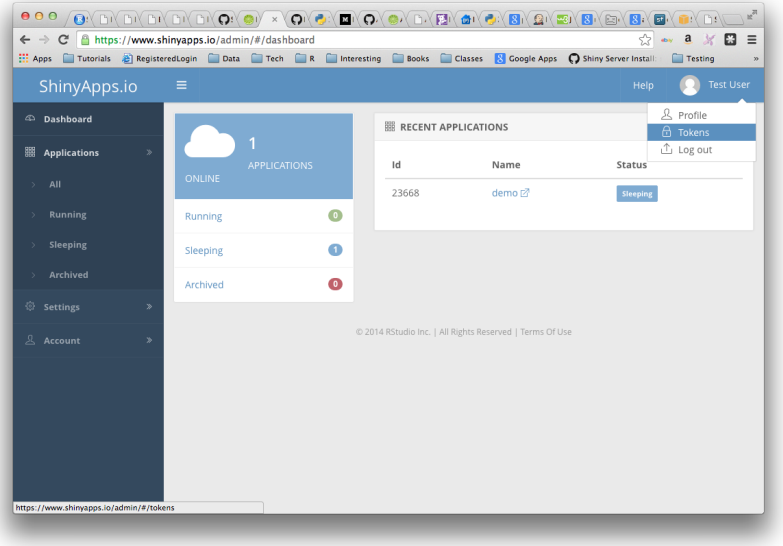
**Create folder called** movies_app

**Move any of the (working) app files into this folder, along with** movies.Rdata

**Go to** http://shinyapps.io**. Sign up for an account (**instructions**).**

# Your turn 7

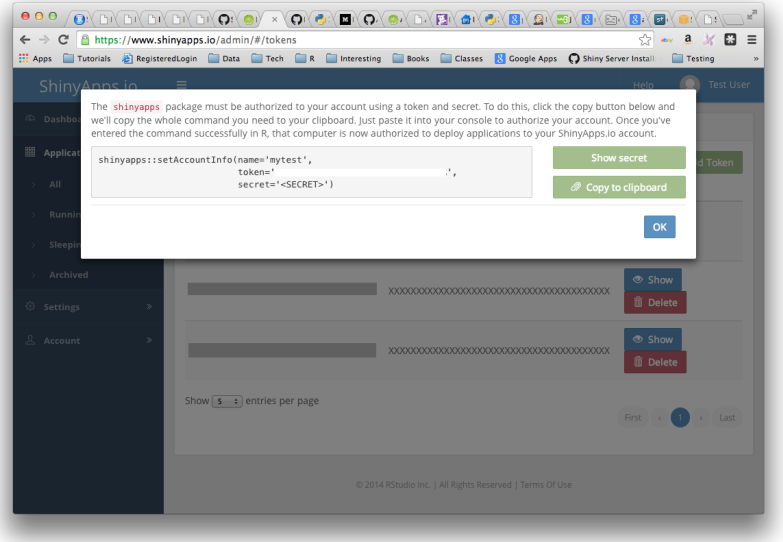
## Click on the 'Tokens' option under your username (upper right corner)



# Your Turn 7

## Click 'Show' button on the 'Token' page

## Copy this to the clipboard, paste it into the console in the RStudio IDE, hit Enter



# Resources

Shiny Website: A collection of articles on Shiny

Mastering Shiny: A Work-in-progress book from Hadley Wickham