Thompson_Hendley_hw5

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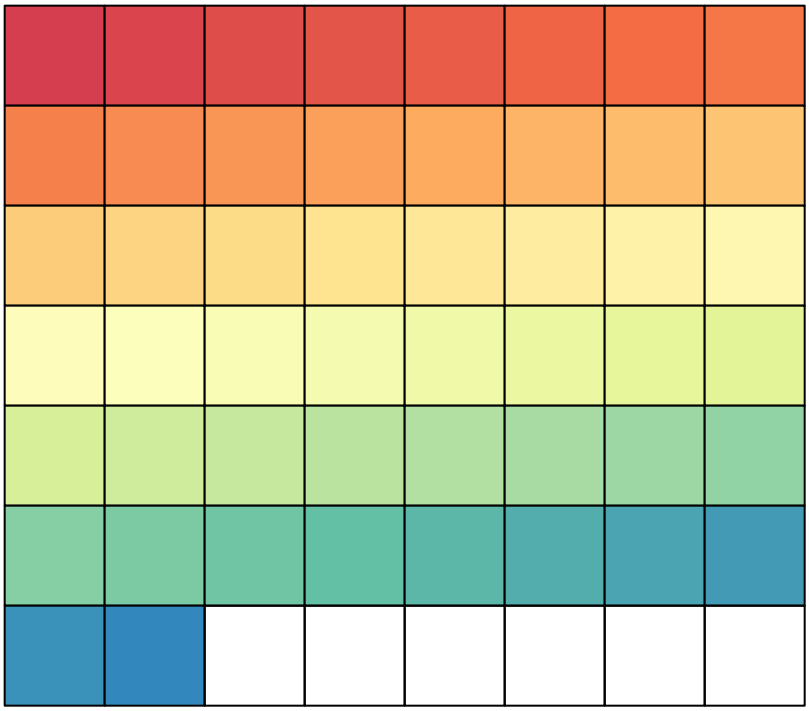
```
## -- Attaching packages --------------------------- tidyverse 1.3.0 --
## v ggplot2 3.3.2     v purrr   0.3.4
## v tibble  3.0.3     v dplyr   1.0.2
## v tidyr   1.1.2     v stringr 1.4.0
## v readr   1.4.0     v forcats 0.5.0
## -- Conflicts ------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
##
## Attaching package: 'scales'
## The following object is masked from 'package:purrr':
##
##     discard
## The following object is masked from 'package:readr':
##
##     col_factor
```

Number 1

```
# Takes the basic color palette and spreads it into 50 colors
expand_palette <- function(n, colors) {
  spread <- colorRampPalette(colors)
  spread(n)
}

colors <- brewer.pal(9, "Spectral")
more_colors <- expand_palette(50, colors)
show_col(more_colors, labels = FALSE)
```



Number 2

```
mgs <- function(A){
  #make skipping vector
  skip_vector <- vector(mode = "integer", length = ncol(A))
  for(i in 1:ncol(A)){
    #normalize
    if(!is.zero(A[, i])){
      A[, i] <- normalize(A[, i])
    }
    #subtract projections
    if(i != ncol(A)){
      for(j in (i + 1):ncol(A)){
        #check if in skip vector
        if(j %in% skip_vector){
          break()
        } else {
          A[, j] <- A[, j] - project_onto(A[, j], A[, i])
          if(is.zero(A[, j])){
            skip_vector[j] <- j
          }
        }
      }
    }
  }
  discard_zero_cols(A)
}

#testing
```

```r
A <- matrix(c(1, 6, 19, 2, 1, 2,  7, 3, 5, 6, 23, 2), nrow = 3, byrow = TRUE)
gs(A)
```

```
##           [,1]       [,2]       [,3]
## [1,] 0.1924501  0.9678053 -0.1622214
## [2,] 0.1924501  0.1248781  0.9733285
## [3,] 0.9622504 -0.2185367 -0.1622214
```

```r
mgs(A)
```

```
##           [,1]       [,2]       [,3]
## [1,] 0.1924501  0.9678053 -0.1622214
## [2,] 0.1924501  0.1248781  0.9733285
## [3,] 0.9622504 -0.2185367 -0.1622214
```

Number 3

```r
#array to tibble
array_to_tibble <- function(a){
  df <- a %>%
  dim() %>%
  map(~ 1:.x) %>%
  expand.grid() %>%
  as_tibble()
names(df) <- paste0("i", 1:length(dim(a)))
df$value <- as.vector(a)
df
}

#testing
mat <- matrix(1:6, nrow = 2)
array_to_tibble(mat)
```

```
## # A tibble: 6 x 3
##      i1    i2 value
##   <int> <int> <int>
## 1     1     1     1
## 2     2     1     2
## 3     1     2     3
## 4     2     2     4
## 5     1     3     5
## 6     2     3     6
```

```r
a <- array(1:24, dim = c(2, 4, 3))
array_to_tibble(a)
```

```
## # A tibble: 24 x 4
##       i1    i2    i3 value
##    <int> <int> <int> <int>
##  1     1     1     1     1
##  2     2     1     1     2
##  3     1     2     1     3
##  4     2     2     1     4
##  5     1     3     1     5
```

```
##  6     2     3     1     6
##  7     1     4     1     7
##  8     2     4     1     8
##  9     1     1     2     9
## 10     2     1     2    10
## # ... with 14 more rows
```

Number 4

```
# The spy function takes as arguments the generated matrix along with the
# number of rows and columns (n) of the square matrix.
spy <- function(mat, n) {
  non_zero_row = c()
  non_zero_col = c()

# Searches through matrix and notes the indices of non-zero elements
  for (i in 1:n) {
    for (j in 1:n) {
      if (mat[i, j] != 0) {
        non_zero_row = c(non_zero_row, i)
        non_zero_col = c(non_zero_col, j)
      }
    }
  }
  # Due to the way R orients the coordinate system, this code
  # calibrates things to output in the desired way
  x_plot <- non_zero_col # col is distance from left
  y_plot <- n - non_zero_row # row is distance from top

  tibble(x = x_plot, y = y_plot)
}

n <-  50
mat <- matrix(0L, nrow = n, ncol = n)
set.seed(2L)
mat[sample(n^2, n)] <- rpois(n, 5)

# Calls the spy function to create the tibble to be plotted
df <- spy(mat, n)

# Uncomment the next two lines and comment all the above to test
# the base case.
# n <- 10
# df <- tibble(x = 1:10, y = 10:1)

ggplot(df, aes(x, y)) +
  # Creats the black box around the plot
  geom_rect(aes(xmin = 0, xmax = n ,
            ymin = 0, ymax = n),
            fill = "white", color = "black", size = 0.2) +
  geom_tile(fill = "black") +
  scale_x_continuous(name = NULL, breaks = NULL, minor_breaks = NULL) +
  scale_y_continuous(name = NULL, breaks = NULL, minor_breaks = NULL) +
```

```
  coord_equal()+
  theme_minimal()
```