Stats 102A - Homework 4 - Output File

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Academic Integrity Statement

By including this statement, I, Joe Bruin, declare that all of the work in this assignment is my own original work. At no time did I look at the code of other students nor did I search for code solutions online. I understand that plagiarism on any single part of this assignment will result in a 0 for the entire assignment and that I will be referred to the dean of students.

```
source("102a_hw_04_script_Yuetong_Li.R")
```

Part 1: Test Cases

do not alter the code for the test cases

Test Case 1: Space: Go to Jail

```
dice <- PresetDice$new(
  rolls = c(3,4),
  verbose = TRUE
)
set.seed(16)
player1 <- Player$new(verbose = TRUE, pos = 24)
monopoly <- SpaceTracker$new(verbose = TRUE)

for(i in 1:1){
  cat("--- Turn", i,"---\n")
  take_turn(player1, monopoly)
  cat("\n")
}
```

```
## --- Turn 1 ---
## Dice Rolled: 3 4
## Player starts at 24: Indiana Avenue.
## Player moves forward 7.
## Player is now at 31: Go to jail.
## Player goes to jail.
## Added tally to 11: Jail.
```

```
print(setNames(monopoly$counts, 1:40))
```

```
##  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
##  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
## 27 28 29 30 31 32 33 34 35 36 37 38 39 40
##  0  0  0  0  0  0  0  0  0  0  0  0  0  0
```

Test Case 2: Chance Card and Doubles Tests: Advance to Go, Reading Railroad, Nearest Railroad, Nearest Utility, No Movement

```r
dice <- PresetDice$new(
  rolls = c(3,4, 4,3, 1,1, 3,4, 5,3),
  verbose = TRUE
)
set.seed(135)
chance <- CardDeck$new(chancedeck, verbose = TRUE)
community <- CardDeck$new(communitydeck, verbose = TRUE)
player1 <- Player$new(verbose = TRUE)
monopoly <- SpaceTracker$new(verbose = TRUE)

for(i in 1:4){
  cat("--- Turn", i,"---\n")
  take_turn(player1, monopoly)
  cat("\n")
}
```

```
## --- Turn 1 ---
## Dice Rolled: 3 4
## Player starts at 1: Go.
## Player moves forward 7.
## Player is now at 8: Chance.
## Added tally to 8: Chance.
## Draw a Chance card.
## Card: Advance to Go
## Player moves to 1: Go
## Added tally to 1: Go.
##
## --- Turn 2 ---
## Dice Rolled: 4 3
## Player starts at 1: Go.
## Player moves forward 7.
## Player is now at 8: Chance.
## Added tally to 8: Chance.
## Draw a Chance card.
## Card: Take a ride on the Reading Railroad
## Player moves to 6: Reading Railroad
## Added tally to 6: Reading Railroad.
##
## --- Turn 3 ---
## Dice Rolled: 1 1
## Doubles count is now 1
## Player starts at 6: Reading Railroad.
## Player moves forward 2.
## Player is now at 8: Chance.
## Added tally to 8: Chance.
## Draw a Chance card.
## Card: Advance token to the nearest Railroad
## Player moves to 16 : Pennsylvania Railroad
## Added tally to 16: Pennsylvania Railroad.
##
```

```
## Player rolled doubles, so they take another turn.
## Dice Rolled: 3 4
## Player starts at 16: Pennsylvania Railroad.
## Player moves forward 7.
## Player is now at 23: Chance.
## Added tally to 23: Chance.
## Draw a Chance card.
## Card: Advance token to nearest Utility
## Player moves to 29 : Water Works
## Added tally to 29: Water Works.
##
## --- Turn 4 ---
## Dice Rolled: 5 3
## Player starts at 29: Water Works.
## Player moves forward 8.
## Player is now at 37: Chance.
## Added tally to 37: Chance.
## Draw a Chance card.
## Card: Bank pays you dividend of $50
```

```r
print(setNames(monopoly$counts, 1:40))
```

```
##  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
##  1  0  0  0  0  1  0  3  0  0  0  0  0  0  0  1  0  0  0  0  0  0  1  0  0  0
## 27 28 29 30 31 32 33 34 35 36 37 38 39 40
##  0  0  1  0  0  0  0  0  0  0  1  0  0  0
```

Test Case 3: Multiple doubles. Community Chest.

```r
dice <- PresetDice$new(
  rolls = c(3,3, 2,2, 2,1, 3,1), verbose = TRUE)

player1 <- Player$new(verbose = TRUE)
monopoly <- SpaceTracker$new(verbose = TRUE)
for(i in 1:2){
  cat("--- Turn", i,"---\n")
  take_turn(player1, monopoly)
  cat("\n")
}
```

```
## --- Turn 1 ---
## Dice Rolled: 3 3
## Doubles count is now 1
## Player starts at 1: Go.
## Player moves forward 6.
## Player is now at 7: Oriental Avenue.
## Added tally to 7: Oriental Avenue.
##
## Player rolled doubles, so they take another turn.
## Dice Rolled: 2 2
## Doubles count is now 2
## Player starts at 7: Oriental Avenue.
## Player moves forward 4.
## Player is now at 11: Jail.
## Added tally to 11: Jail.
##
## Player rolled doubles, so they take another turn.
## Dice Rolled: 2 1
## Player starts at 11: Jail.
## Player moves forward 3.
## Player is now at 14: States Avenue.
## Added tally to 14: States Avenue.
##
## --- Turn 2 ---
## Dice Rolled: 3 1
## Player starts at 14: States Avenue.
## Player moves forward 4.
## Player is now at 18: Community Chest.
## Added tally to 18: Community Chest.
## Draw a Community Chest card.
## Card: Life insurance matures. Collect $100
```

```r
print(setNames(monopoly$counts, 1:40))
```

```
##  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
##  0  0  0  0  0  0  1  0  0  0  1  0  0  1  0  0  0  1  0  0  0  0  0  0  0  0
## 27 28 29 30 31 32 33 34 35 36 37 38 39 40
##  0  0  0  0  0  0  0  0  0  0  0  0  0  0
```

Test Case 4: Doubles three times. Three turns in jail.

```r
dice <- PresetDice$new(
  rolls = c(3,3, 3,3, 3,3, 5,6, 5,6, 5,6),
  verbose = TRUE
)

player1 <- Player$new(verbose = TRUE)
monopoly <- SpaceTracker$new(verbose = TRUE)

for(i in 1:4){
  cat("--- Turn", i,"---\n")
  take_turn(player1, monopoly)
  cat("\n")
}
```

```
## --- Turn 1 ---
## Dice Rolled: 3 3
## Doubles count is now 1
## Player starts at 1: Go.
## Player moves forward 6.
## Player is now at 7: Oriental Avenue.
## Added tally to 7: Oriental Avenue.
##
## Player rolled doubles, so they take another turn.
## Dice Rolled: 3 3
## Doubles count is now 2
## Player starts at 7: Oriental Avenue.
## Player moves forward 6.
## Player is now at 13: Electric Company.
## Added tally to 13: Electric Company.
##
## Player rolled doubles, so they take another turn.
## Dice Rolled: 3 3
## Doubles count is now 3
## Player goes to jail.
## Added tally to 11: Jail.
##
## --- Turn 2 ---
## Dice Rolled: 5 6
## Player stays in jail.
## Added tally to 11: Jail.
##
## --- Turn 3 ---
## Dice Rolled: 5 6
## Player stays in jail.
## Added tally to 11: Jail.
##
## --- Turn 4 ---
## Dice Rolled: 5 6
## Player's third turn in jail. Player must exit jail.
## Player exits jail.
## Player starts at 11: Jail.
```

```
## Player moves forward 11.
## Player is now at 22: Kentucky Avenue.
## Added tally to 22: Kentucky Avenue.
```

```
print(setNames(monopoly$counts, 1:40))
```

```
##  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
##  0  0  0  0  0  0  1  0  0  0  3  0  1  0  0  0  0  0  0  0  0  1  0  0  0  0
## 27 28 29 30 31 32 33 34 35 36 37 38 39 40
##  0  0  0  0  0  0  0  0  0  0  0  0  0  0
```

Test Case 5: After going to Jail, player's turn ends immediately. Rolling doubles while in Jail gets player out of jail.

```
dice <- PresetDice$new(
  rolls = c(3,3, 1,2, 3,3, 3,4),
  verbose = TRUE
)

player1 <- Player$new(verbose = TRUE, pos = 25)
monopoly <- SpaceTracker$new(verbose = TRUE)

for(i in 1:3){
  cat("--- Turn", i,"---\n")
  take_turn(player1, monopoly)
  cat("\n")
}
```

```
## --- Turn 1 ---
## Dice Rolled: 3 3
## Doubles count is now 1
## Player starts at 25: Illinois Avenue.
## Player moves forward 6.
## Player is now at 31: Go to jail.
## Player goes to jail.
## Added tally to 11: Jail.
##
## --- Turn 2 ---
## Dice Rolled: 1 2
## Player stays in jail.
## Added tally to 11: Jail.
##
## --- Turn 3 ---
## Dice Rolled: 3 3
## In jail but rolled doubles.
## Player exits jail.
## Player starts at 11: Jail.
## Player moves forward 6.
## Player is now at 17: St. James Place.
## Added tally to 17: St. James Place.
```

```
print(setNames(monopoly$counts, 1:40))
```

```
##  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
##  0  0  0  0  0  0  0  0  0  0  2  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0
## 27 28 29 30 31 32 33 34 35 36 37 38 39 40
##  0  0  0  0  0  0  0  0  0  0  0  0  0  0
```

Test Case 6: 20 Predetermined Turns

```r
## You must use these dice for Part 1
dice <- PresetDice$new(
  rolls = c(6,4, 5,3, 3,5, 4,4, 4,4, 2,2, 4,3, 4,4, 1,4,
            3,4, 1,2, 3,6, 5,4, 5,5, 1,2, 5,4, 3,3, 6,1,
            1,1, 2,3, 5,5, 5,4, 4,1, 2,2, 2,4),
  verbose = TRUE
)
set.seed(2)
chance <- CardDeck$new(chancedeck, verbose = TRUE)
community <- CardDeck$new(communitydeck, verbose = TRUE)
# if your chance cards different from mine,
# check to make sure sample(15) returns the following
# > set.seed(2)
# > sample(15)
#  [1]  5  6 14  8  1 11  9  2  3 10  7 12  4 13 15
```

```r
player1 <- Player$new(verbose = TRUE)
monopoly <- SpaceTracker$new(verbose = TRUE)

for(i in 1:20){
  cat("--- Turn", i,"---\n")
  take_turn(player1, monopoly)
  cat("\n")
}
```

```
## --- Turn 1 ---
## Dice Rolled: 6 4
## Player starts at 1: Go.
## Player moves forward 10.
## Player is now at 11: Jail.
## Added tally to 11: Jail.
##
## --- Turn 2 ---
## Dice Rolled: 5 3
## Player starts at 11: Jail.
## Player moves forward 8.
## Player is now at 19: Tennessee Avenue.
## Added tally to 19: Tennessee Avenue.
##
## --- Turn 3 ---
## Dice Rolled: 3 5
## Player starts at 19: Tennessee Avenue.
## Player moves forward 8.
## Player is now at 27: Atlantic Avenue.
## Added tally to 27: Atlantic Avenue.
##
## --- Turn 4 ---
## Dice Rolled: 4 4
## Doubles count is now 1
## Player starts at 27: Atlantic Avenue.
```

```
## Player moves forward 8.
## Player is now at 35: Pennsylvania Avenue.
## Added tally to 35: Pennsylvania Avenue.
##
## Player rolled doubles, so they take another turn.
## Dice Rolled: 4 4
## Doubles count is now 2
## Player starts at 35: Pennsylvania Avenue.
## Player moves forward 8.
## Player is now at 3: Community Chest.
## Added tally to 3: Community Chest.
## Draw a Community Chest card.
## Card: You have won second prize in a beauty contest
##
## Player rolled doubles, so they take another turn.
## Dice Rolled: 2 2
## Doubles count is now 3
## Player goes to jail.
## Added tally to 11: Jail.
##
## --- Turn 5 ---
## Dice Rolled: 4 3
## Player stays in jail.
## Added tally to 11: Jail.
##
## --- Turn 6 ---
## Dice Rolled: 4 4
## In jail but rolled doubles.
## Player exits jail.
## Player starts at 11: Jail.
## Player moves forward 8.
## Player is now at 19: Tennessee Avenue.
## Added tally to 19: Tennessee Avenue.
##
## --- Turn 7 ---
## Dice Rolled: 1 4
## Player starts at 19: Tennessee Avenue.
## Player moves forward 5.
## Player is now at 24: Indiana Avenue.
## Added tally to 24: Indiana Avenue.
##
## --- Turn 8 ---
## Dice Rolled: 3 4
## Player starts at 24: Indiana Avenue.
## Player moves forward 7.
## Player is now at 31: Go to jail.
## Player goes to jail.
## Added tally to 11: Jail.
##
## --- Turn 9 ---
## Dice Rolled: 1 2
## Player stays in jail.
## Added tally to 11: Jail.
##
```

```
## --- Turn 10 ---
## Dice Rolled: 3 6
## Player stays in jail.
## Added tally to 11: Jail.
##
## --- Turn 11 ---
## Dice Rolled: 5 4
## Player's third turn in jail. Player must exit jail.
## Player exits jail.
## Player starts at 11: Jail.
## Player moves forward 9.
## Player is now at 20: New York Avenue.
## Added tally to 20: New York Avenue.
##
## --- Turn 12 ---
## Dice Rolled: 5 5
## Doubles count is now 1
## Player starts at 20: New York Avenue.
## Player moves forward 10.
## Player is now at 30: Marvin Gardens.
## Added tally to 30: Marvin Gardens.
##
## Player rolled doubles, so they take another turn.
## Dice Rolled: 1 2
## Player starts at 30: Marvin Gardens.
## Player moves forward 3.
## Player is now at 33: North Carolina Avenue.
## Added tally to 33: North Carolina Avenue.
##
## --- Turn 13 ---
## Dice Rolled: 5 4
## Player starts at 33: North Carolina Avenue.
## Player moves forward 9.
## Player is now at 2: Mediterranean Avenue.
## Added tally to 2: Mediterranean Avenue.
##
## --- Turn 14 ---
## Dice Rolled: 3 3
## Doubles count is now 1
## Player starts at 2: Mediterranean Avenue.
## Player moves forward 6.
## Player is now at 8: Chance.
## Added tally to 8: Chance.
## Draw a Chance card.
## Card: Advance token to the nearest Railroad
## Player moves to 16 : Pennsylvania Railroad
## Added tally to 16: Pennsylvania Railroad.
##
## Player rolled doubles, so they take another turn.
## Dice Rolled: 6 1
## Player starts at 16: Pennsylvania Railroad.
## Player moves forward 7.
## Player is now at 23: Chance.
## Added tally to 23: Chance.
```

```
## Draw a Chance card.
## Card: Take a ride on the Reading Railroad
## Player moves to 6: Reading Railroad
## Added tally to 6: Reading Railroad.
##
## --- Turn 15 ---
## Dice Rolled: 1 1
## Doubles count is now 1
## Player starts at 6: Reading Railroad.
## Player moves forward 2.
## Player is now at 8: Chance.
## Added tally to 8: Chance.
## Draw a Chance card.
## Card: You have been elected Chairman of the Board
##
## Player rolled doubles, so they take another turn.
## Dice Rolled: 2 3
## Player starts at 8: Chance.
## Player moves forward 5.
## Player is now at 13: Electric Company.
## Added tally to 13: Electric Company.
##
## --- Turn 16 ---
## Dice Rolled: 5 5
## Doubles count is now 1
## Player starts at 13: Electric Company.
## Player moves forward 10.
## Player is now at 23: Chance.
## Added tally to 23: Chance.
## Draw a Chance card.
## Card: Go to Jail
## Player goes to jail.
## Added tally to 11: Jail.
##
## --- Turn 17 ---
## Dice Rolled: 5 4
## Player stays in jail.
## Added tally to 11: Jail.
##
## --- Turn 18 ---
## Dice Rolled: 4 1
## Player stays in jail.
## Added tally to 11: Jail.
##
## --- Turn 19 ---
## Dice Rolled: 2 2
## In jail but rolled doubles.
## Player exits jail.
## Player starts at 11: Jail.
## Player moves forward 4.
## Player is now at 15: Virginia Avenue.
## Added tally to 15: Virginia Avenue.
##
## --- Turn 20 ---
```

```
## Dice Rolled: 2 4
## Player starts at 15: Virginia Avenue.
## Player moves forward 6.
## Player is now at 21: Free Parking.
## Added tally to 21: Free Parking.
```

monopoly$counts

```
##  [1] 0 1 1 0 0 1 0 2 0 0 9 0 1 0 1 1 0 0 2 1 1 0 2 1 0 0 1 0 0 1 0 0 1 0 1 0 1 0 0 0
## [39] 0 0
```

cbind(gameboard, counts = monopoly$counts)

```
##    space                 title counts
## 1      1                    Go      0
## 2      2   Mediterranean Avenue      1
## 3      3        Community Chest      1
## 4      4          Baltic Avenue      0
## 5      5             Income Tax      0
## 6      6       Reading Railroad      1
## 7      7        Oriental Avenue      0
## 8      8                 Chance      2
## 9      9         Vermont Avenue      0
## 10    10     Connecticut Avenue      0
## 11    11                   Jail      9
## 12    12      St. Charles Place      0
## 13    13       Electric Company      1
## 14    14          States Avenue      0
## 15    15        Virginia Avenue      1
## 16    16   Pennsylvania Railroad     1
## 17    17        St. James Place      0
## 18    18        Community Chest      0
## 19    19       Tennessee Avenue      2
## 20    20        New York Avenue      1
## 21    21           Free Parking      1
## 22    22        Kentucky Avenue      0
## 23    23                 Chance      2
## 24    24         Indiana Avenue      1
## 25    25        Illinois Avenue      0
## 26    26          B & O Railroad     0
## 27    27        Atlantic Avenue      1
## 28    28         Ventnor Avenue      0
## 29    29            Water Works      0
## 30    30         Marvin Gardens      1
## 31    31             Go to jail      0
## 32    32         Pacific Avenue      0
## 33    33 North Carolina Avenue      1
## 34    34        Community Chest      0
## 35    35    Pennsylvania Avenue      1
## 36    36     Short Line Railroad      0
## 37    37                 Chance      0
## 38    38             Park Place      0
## 39    39             Luxury Tax      0
## 40    40              Boardwalk      0
```

Part 2: 1000 simulated games

```r
library(dplyr)
```

```r
## Use non-verbose random dice for Part 2
set.seed(2)
chance <- CardDeck$new(chancedeck, verbose = F)
community <- CardDeck$new(communitydeck, verbose = F)
dice <- RandomDice$new()
#set.seed(2)
player1 <- Player$new(verbose = F)
player2 <- Player$new(verbose = F)
monopoly <- SpaceTracker$new(verbose = F)

for(g in 1:1000) {
  if(g %% 100 == 0) {
    cat("#### SIMULATING GAME", g, "##### \n")
  }

  for(i in 1:150){
    take_turn(player1, monopoly)
    take_turn(player2, monopoly)
  }
}
```

```
## #### SIMULATING GAME 100 #####
## #### SIMULATING GAME 200 #####
## #### SIMULATING GAME 300 #####
## #### SIMULATING GAME 400 #####
## #### SIMULATING GAME 500 #####
## #### SIMULATING GAME 600 #####
## #### SIMULATING GAME 700 #####
## #### SIMULATING GAME 800 #####
## #### SIMULATING GAME 900 #####
## #### SIMULATING GAME 1000 #####
```

```r
print(setNames(monopoly$counts, 1:40))
```

```
##     1     2     3     4     5     6     7     8     9    10    11    12    13
## 10115  7047  7138  7181  7835  9383  7502  7666  7777  7562 39828  9025  9221
##    14    15    16    17    18    19    20    21    22    23    24    25    26
##  7542  8604  8812  9400  9034  9946  9683  9860  9196  9612  8912 10568  9383
##    27    28    29    30    31    32    33    34    35    36    37    38    39
##  9010  8936  9563  8593     0  8620  8690  8943  8300  8095  7657  7040  7376
##    40
##  8729
```

```r
results <- cbind(gameboard, tally = monopoly$counts)
results <- cbind(results, rel = monopoly$counts/sum(monopoly$counts))
print(results)
```

```
##    space                 title tally         rel
## 1      1                    Go 10115 0.02753250
## 2      2 Mediterranean Avenue  7047 0.01918156
## 3      3     Community Chest    7138 0.01942926
## 4      4        Baltic Avenue   7181 0.01954631
## 5      5          Income Tax    7835 0.02132646
## 6      6     Reading Railroad   9383 0.02554003
## 7      7      Oriental Avenue   7502 0.02042005
## 8      8               Chance   7666 0.02086645
## 9      9       Vermont Avenue   7777 0.02116859
## 10    10   Connecticut Avenue   7562 0.02058337
## 11    11                 Jail 39828 0.10840973
## 12    12    St. Charles Place   9025 0.02456558
## 13    13     Electric Company   9221 0.02509908
## 14    14        States Avenue   7542 0.02052893
## 15    15      Virginia Avenue   8604 0.02341964
## 16    16 Pennsylvania Railroad  8812 0.02398580
## 17    17       St. James Place   9400 0.02558631
## 18    18      Community Chest    9034 0.02459007
## 19    19     Tennessee Avenue   9946 0.02707249
## 20    20      New York Avenue   9683 0.02635662
## 21    21         Free Parking   9860 0.02683840
## 22    22      Kentucky Avenue   9196 0.02503103
## 23    23               Chance   9612 0.02616336
## 24    24       Indiana Avenue   8912 0.02425800
## 25    25      Illinois Avenue 10568 0.02876554
## 26    26         B & O Railroad  9383 0.02554003
## 27    27      Atlantic Avenue   9010 0.02452475
## 28    28       Ventnor Avenue   8936 0.02432332
## 29    29          Water Works   9563 0.02602998
## 30    30       Marvin Gardens   8593 0.02338970
## 31    31            Go to jail     0 0.00000000
## 32    32       Pacific Avenue   8620 0.02346319
## 33    33 North Carolina Avenue  8690 0.02365372
## 34    34      Community Chest    8943 0.02434238
## 35    35   Pennsylvania Avenue   8300 0.02259217
## 36    36    Short Line Railroad  8095 0.02203417
## 37    37               Chance   7657 0.02084195
## 38    38           Park Place   7040 0.01916251
## 39    39           Luxury Tax   7376 0.02007709
## 40    40            Boardwalk   8729 0.02375988
```

```
arrange(results, desc(tally))
```

```
##   space                 title tally         rel
## 1    11                 Jail 39828 0.10840973
## 2    25      Illinois Avenue 10568 0.02876554
## 3     1                   Go 10115 0.02753250
## 4    19     Tennessee Avenue  9946 0.02707249
## 5    21         Free Parking  9860 0.02683840
## 6    20      New York Avenue  9683 0.02635662
## 7    23               Chance  9612 0.02616336
## 8    29          Water Works  9563 0.02602998
## 9    17      St. James Place  9400 0.02558631
```

```
## 10     6      Reading Railroad  9383 0.02554003
## 11    26        B & O Railroad  9383 0.02554003
## 12    13       Electric Company  9221 0.02509908
## 13    22        Kentucky Avenue  9196 0.02503103
## 14    18        Community Chest  9034 0.02459007
## 15    12      St. Charles Place  9025 0.02456558
## 16    27        Atlantic Avenue  9010 0.02452475
## 17    34        Community Chest  8943 0.02434238
## 18    28         Ventnor Avenue  8936 0.02432332
## 19    24         Indiana Avenue  8912 0.02425800
## 20    16  Pennsylvania Railroad  8812 0.02398580
## 21    40              Boardwalk  8729 0.02375988
## 22    33  North Carolina Avenue  8690 0.02365372
## 23    32         Pacific Avenue  8620 0.02346319
## 24    15        Virginia Avenue  8604 0.02341964
## 25    30          Marvin Gardens  8593 0.02338970
## 26    35     Pennsylvania Avenue  8300 0.02259217
## 27    36      Short Line Railroad  8095 0.02203417
## 28     5             Income Tax  7835 0.02132646
## 29     9         Vermont Avenue  7777 0.02116859
## 30     8                 Chance  7666 0.02086645
## 31    37                 Chance  7657 0.02084195
## 32    10     Connecticut Avenue  7562 0.02058337
## 33    14          States Avenue  7542 0.02052893
## 34     7        Oriental Avenue  7502 0.02042005
## 35    39             Luxury Tax  7376 0.02007709
## 36     4          Baltic Avenue  7181 0.01954631
## 37     3        Community Chest  7138 0.01942926
## 38     2  Mediterranean Avenue  7047 0.01918156
## 39    38             Park Place  7040 0.01916251
## 40    31             Go to jail     0 0.00000000
```

```r
# set colors for the bar plot
color_vec <- rep(NA, 40)
color_vec[c(2,4)] <- "chocolate4" # mediterranean, baltic
color_vec[c(7,9,10)] <- "lightskyblue" # oriental, vermont, connecticut
color_vec[c(12,14,15)] <- "darkorchid2" # st charles, states, virgina
color_vec[c(17,19,20)] <- "darkorange" # st james, tennessee, new york
color_vec[c(22,24,25)] <- "red2" # kentucky, indiana, illinois
color_vec[c(27,28,30)] <- "gold1" # atlantic, ventnor, marvin
color_vec[c(32,33,35)] <- "darkgreen" # pacific, n. carolina, pennsylvania
color_vec[c(38,40)] <- "blue3" # park place, boardwalk
color_vec[c(6,16,26,36)] <- "gray14" # railroads
color_vec[c(13,29)] <- "palegreen1" # utilities
color_vec[c(8,23,37)] <- "salmon2" # chance
color_vec[c(3,18,34)] <- "deepskyblue" # community chest

barplot(monopoly$counts,
        main = "Barplot of Frequency of Landing for Each Space",
        xlab = "Space Number", ylab = "Number of Landings",
        las = 2, col = color_vec, names.arg = 1:40, cex.names = 0.65)
```

Barplot of Frequency of Landing for Each Space
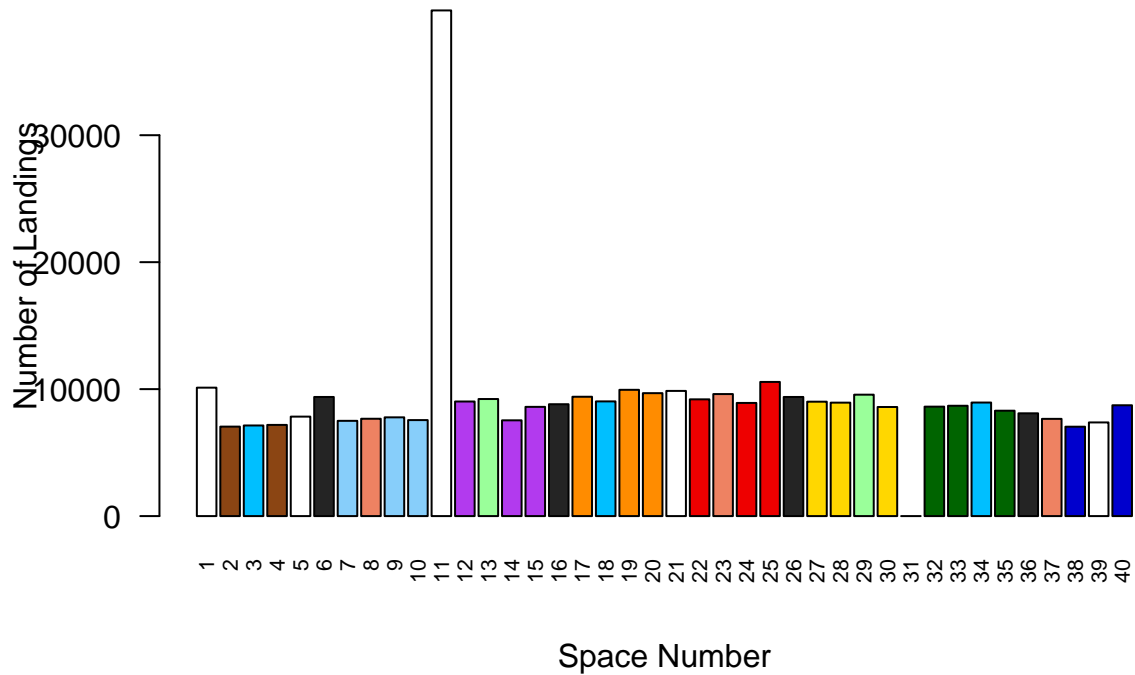

```r
# this one sets the y-limits so the max count of jail doesn't shrink everything
barplot(monopoly$counts,
        main = "Barplot of Frequency of Landing for Each Space",
        xlab = "Space Number", ylab = "Number of Landings",
        las = 2, col = color_vec, names.arg = 1:40, cex.names = 0.65,
        ylim = c(0, sort(monopoly$counts, decreasing = TRUE)[2]))
```

Barplot of Frequency of Landing for Each Space

Number of Landings / Space Number