Stats 102A - Homework 4 - Output File

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Academic Integrity Statement

By including this statement, I, Simon Zhang, 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_Simon_Zhang.R")  # edit with your file name
```

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

```
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
```

```
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.

```
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
```

```
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.

```
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 extis 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

```
## 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
```

```
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 extis 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
## Player's third turn in jail. Player must exit jail.
## 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 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

```
library(dplyr)
```

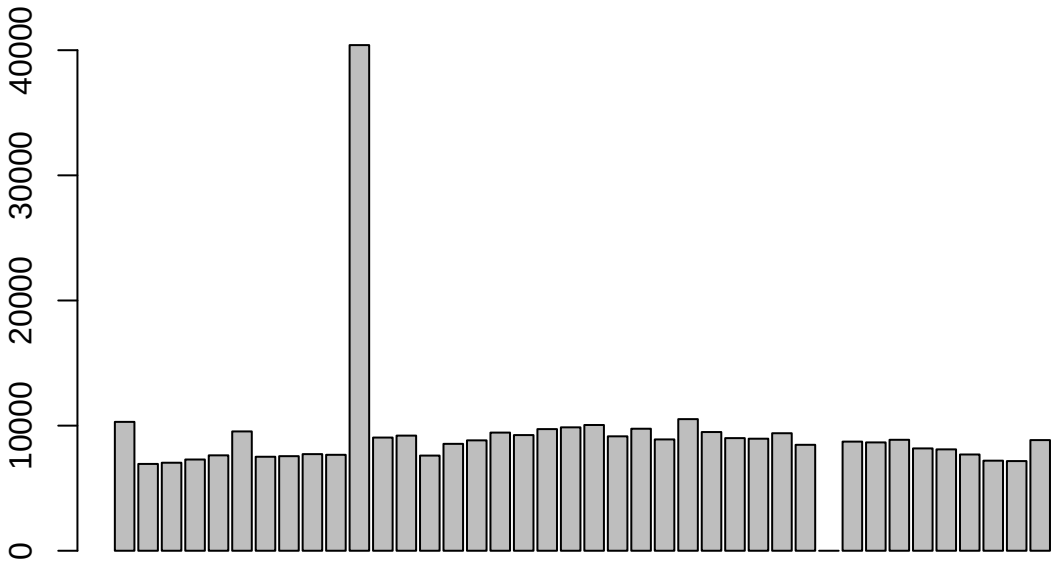
```
## Use non-verbose random dice for Part 2
set.seed(2)
chance <- CardDeck$new(chancedeck, verbose = FALSE)
community <- CardDeck$new(communitydeck, verbose = FALSE)
dice <- RandomDice$new()

player1 <- Player$new(verbose = FALSE)
player2 <- Player$new(verbose = FALSE)
monopoly <- SpaceTracker$new(verbose = FALSE)

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 #####
```

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

```
##     1     2     3     4     5     6     7     8     9    10    11    12    13
## 10298  6938  7035  7293  7624  9537  7511  7559  7723  7667 40408  9046  9202
##    14    15    16    17    18    19    20    21    22    23    24    25    26
##  7606  8542  8823  9443  9245  9722  9863 10050  9143  9751  8896 10518  9488
##    27    28    29    30    31    32    33    34    35    36    37    38    39
##  9001  8955  9391  8467     0  8722  8658  8867  8179  8101  7692  7199  7167
##    40
##  8844
```

```
barplot(monopoly$counts)
```




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

```
##    space                 title tally        rel
## 1      1                    Go 10298 0.02797047
## 2      2  Mediterranean Avenue  6938 0.01884435
## 3      3       Community Chest  7035 0.01910781
## 4      4         Baltic Avenue  7293 0.01980857
## 5      5             Income Tax  7624 0.02070760
## 6      6      Reading Railroad  9537 0.02590351
## 7      7       Oriental Avenue  7511 0.02040068
## 8      8                Chance  7559 0.02053105
## 9      9        Vermont Avenue  7723 0.02097649
## 10    10    Connecticut Avenue  7667 0.02082439
## 11    11                  Jail 40408 0.10975245
## 12    12     St. Charles Place  9046 0.02456990
## 13    13      Electric Company  9202 0.02499362
## 14    14         States Avenue  7606 0.02065871
## 15    15       Virginia Avenue  8542 0.02320099
## 16    16 Pennsylvania Railroad  8823 0.02396421
## 17    17       St. James Place  9443 0.02564820
## 18    18       Community Chest  9245 0.02511041
## 19    19      Tennessee Avenue  9722 0.02640599
## 20    20       New York Avenue  9863 0.02678896
## 21    21          Free Parking 10050 0.02729688
## 22    22       Kentucky Avenue  9143 0.02483337
## 23    23                Chance  9751 0.02648476
## 24    24        Indiana Avenue  8896 0.02416249
## 25    25       Illinois Avenue 10518 0.02856801
## 26    26        B & O Railroad  9488 0.02577042
## 27    27       Atlantic Avenue  9001 0.02444768
## 28    28        Ventnor Avenue  8955 0.02432274
## 29    29           Water Works  9391 0.02550696
## 30    30        Marvin Gardens  8467 0.02299728
## 31    31            Go to jail     0 0.00000000
```

```
## 32    32        Pacific Avenue  8722 0.02368989
## 33    33 North Carolina Avenue  8658 0.02351605
## 34    34       Community Chest  8867 0.02408372
## 35    35   Pennsylvania Avenue  8179 0.02221504
## 36    36   Short Line Railroad  8101 0.02200318
## 37    37                Chance  7692 0.02089230
## 38    38           Park Place  7199 0.01955325
## 39    39           Luxury Tax  7167 0.01946634
## 40    40            Boardwalk  8844 0.02402125
```

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

```
##    space                 title tally        rel
## 1     11                  Jail 40408 0.10975245
## 2     25       Illinois Avenue 10518 0.02856801
## 3      1                    Go 10298 0.02797047
## 4     21          Free Parking 10050 0.02729688
## 5     20       New York Avenue  9863 0.02678896
## 6     23                Chance  9751 0.02648476
## 7     19      Tennessee Avenue  9722 0.02640599
## 8      6      Reading Railroad  9537 0.02590351
## 9     26        B & O Railroad  9488 0.02577042
## 10    17       St. James Place  9443 0.02564820
## 11    29           Water Works  9391 0.02550696
## 12    18       Community Chest  9245 0.02511041
## 13    13      Electric Company  9202 0.02499362
## 14    22       Kentucky Avenue  9143 0.02483337
## 15    12     St. Charles Place  9046 0.02456990
## 16    27       Atlantic Avenue  9001 0.02444768
## 17    28        Ventnor Avenue  8955 0.02432274
## 18    24        Indiana Avenue  8896 0.02416249
## 19    34       Community Chest  8867 0.02408372
## 20    40             Boardwalk  8844 0.02402125
## 21    16 Pennsylvania Railroad  8823 0.02396421
## 22    32        Pacific Avenue  8722 0.02368989
## 23    33 North Carolina Avenue  8658 0.02351605
## 24    15       Virginia Avenue  8542 0.02320099
## 25    30        Marvin Gardens  8467 0.02299728
## 26    35   Pennsylvania Avenue  8179 0.02221504
## 27    36   Short Line Railroad  8101 0.02200318
## 28     9        Vermont Avenue  7723 0.02097649
## 29    37                Chance  7692 0.02089230
## 30    10    Connecticut Avenue  7667 0.02082439
## 31     5            Income Tax  7624 0.02070760
## 32    14         States Avenue  7606 0.02065871
## 33     8                Chance  7559 0.02053105
## 34     7       Oriental Avenue  7511 0.02040068
## 35     4         Baltic Avenue  7293 0.01980857
## 36    38            Park Place  7199 0.01955325
## 37    39            Luxury Tax  7167 0.01946634
## 38     3       Community Chest  7035 0.01910781
## 39     2  Mediterranean Avenue  6938 0.01884435
## 40    31            Go to jail     0 0.00000000
```