

Play Your Mega Millions

Sta 523 - Final Project

AUTHORS

Yanjiao Yang

Huiying Lin

Hanyue Liang

Ruixin Pang

Introduction

Mega Millions is an American multi-jurisdictional lottery game. Players pick six numbers from two separate pools of numbers - five different numbers from 1 to 70, and one number from 1 to 25 - or select Easy Pick/Quick Pick. You win the jackpot by matching all six winning numbers in a drawing. The drawing is at 11 p.m. Eastern Time every Tuesday and Friday evening, beginning from 2002.

This project uses the lottery data from Texas Mega Millions and designs a shiny app for users to retrieve past drawings and explores statistics via tables and plots. Based on the statistics, users are also allowed to generate new potential winning numbers. The remaining of the write up is structured as follows: the data section will introduce how the data is obtained, followed by the coding logic and design of the app in the method section. The result section will provide an overview of each dashboard in the shiny app and the discussion section will conclude the project as well as propose future improvements.

Lottery Data

This section will elaborate on how the lottery data is obtained. We scrape past drawings of Mega Millions from <https://www.texaslottery.com>, as in `get_lottery.R`. Specifically, we first get all the past drawings from 2003 to 2022 and store it in a data frame. To clean the data and facilitate the analysis in the shiny app, we create columns of year, month and day and all the five winning numbers for each drawing. The unit of the Estimated.jackpot column is unified to be million dollars. Since each drawing is linked to a webpage that records the detailed information, we choose to scrape Number.Correct, Prize.Amount, Total.Texas.Winners from each page, save them as a list, and combine with the original data frame. The first 5 rows of the lottery data and the first record of detail information are presented below. The tidy data is saved as `lottery.rds` for future usage.

Table 1: 1

month	day	year	first	second	third	fourth	fifth	Mega.Ball	Megaplier	Jackpot.Winners	Estimated.Jac
12	16	2022	8	35	40	53	56	11	3	Roll	429
12	13	2022	14	22	48	58	68	6	2	Roll	400
12	09	2022	8	19	53	61	69	19	4	Roll	379
12	06	2022	15	16	19	28	47	13	3	Roll	354
12	02	2022	1	21	36	46	52	16	3	Roll	333

Table 2: The first detailed information of the lottery

Number.Correct	Prize.Amount	Total.Texas.Winners
5 of 5 w/Mega Ball	\$429 Million	Roll
5 of 5	\$1 Million	0
4 of 5 w/Mega Ball	\$10,000	1
4 of 5	\$500	32
3 of 5 w/Mega Ball	\$200	118
3 of 5	\$10	2,761
2 of 5 w/Mega Ball	\$10	2,586
1 of 5 w/Mega Ball	\$4	21,277
0 of 5 w/Mega Ball	\$2	53,373

Shiny App

The Shiny App is built using the collected lottery data, as in `shinyapp.R`. The shiny app includes four sections. In the *Dashboard* section, a brief introduction of Mega Millions and the app is presented. This page facilitates users to understand the Mega Millions and the function of the shiny app.

Texas Lottery

Dashboard

Past Drawings

Lottery Statistics

Generate New Winning Numbers

Mega Millions Summary and Analysis

By STA523L Team LLPY

What is Mega Millions?

Mega Millions (originally known as The Big Game in 1996 and renamed, temporarily, to The Big Game Mega Millions six years later) is an American multi-jurisdictional lottery game; as of January 30, 2020, it is offered in 45 states, the District of Columbia, and the U.S. Virgin Islands. The first (The Big Game) Mega Millions drawing was in 2002. What is now Mega Millions initially was offered in six states; the logo for all versions of the game following the retirement of The Big Game name featured a gold-colored ball with six stars to represent the game's initial membership, although some lotteries insert their respective logo in the ball. Mega Millions is drawn at 11 p.m. Eastern Time on Tuesday and Friday evenings, including holidays.[5] Mega Millions is administered by a consortium of its 12 original lotteries;[6] the drawings are held at the studios of WSB-TV in Atlanta, Georgia, supervised by the Georgia Lottery.[7] The hosts are John Crow, Carol Blackmon and Adrian Wollford.

How to Play Mega Millions?

Players may pick six numbers from two separate pools of numbers - five different numbers from 1 to 70 (the white balls) and one number from 1 to 25 (the gold Mega Ball) - or select Easy Pick/Quick Pick. You win the jackpot by matching all six winning numbers in a drawing. Until further notice, the starting jackpot will vary based on sales and will be announced before each drawing.

There are a total of nine ways to win a prize in Mega Millions, ranging from the jackpot down to \$2:

MEGA MILLIONS* PRIZE CHART

MATCH	MEGA MILLIONS PRIZE	ODDS OF WINNING
5 White Balls + Gold Mega Ball	Grand Prize*	1:302,575,350
5 White Balls	\$1,000,000	1:12,607,306
4 White Balls + Gold Mega Ball	\$10,000	1:931,601
4 White Balls	\$500	1:38,792
3 White Balls + Gold Mega Ball	\$200	1:14,547
3 White Balls	\$10	1:606
2 White Balls + Gold Mega Ball	\$10	1:693
1 White Ball + Gold Mega Ball	\$4	1:89
Gold Mega Ball	\$2	1:37

MEGAPLIER** PRIZE CHART**

(PRIZES BELOW INCLUDE THE BASE PRIZE AMOUNT)

2X (ODDS 1:2)	3X (ODDS 1:3)	4X (ODDS 1:4)	5X (ODDS 1:5)
YOUR TOTAL PRIZE BECOMES:			
\$2,000,000	\$3,000,000	\$4,000,000	\$5,000,000
\$50,000	\$30,000	\$40,000	\$50,000
\$1,000	\$1,500	\$2,000	\$2,500
\$400	\$600	\$800	\$1,000
\$20	\$30	\$40	\$50
\$70	\$30	\$40	\$50
\$8	\$12	\$16	\$20
\$4	\$4	\$8	\$10

*Mega Millions overall odds are 1 in 24.0 (including break-even prizes). All non-Grand Prizes are guaranteed prizes. If funds are insufficient to pay guaranteed prizes, some non-Grand Prizes may be paid on a paid-in-lieu basis and could be lower than the amounts shown. Megaplier prizes that are awarded if non-Grand Prizes are paid on a paid-in-lieu basis.
**The Grand Prize is paid-in-lieu and will be divided equally by the number of Grand Prize winners.
**Megaplier does not apply to The Mega Millions Grand Prize or the Jackpot Prize.

What Our App Can Do?

In the Dashboard section, you may get a general impression of how the lottery works.
In the Past drawing section, you may enter the start date and end date of the records you want to retrieve. Then simply click 'Submit', our app would provide you the information of previous drawings, including drawing date, winning numbers, estimated Jackpot, and so on. You may also click the hyperlink to get the detailed information about the winning Jackpot.
In the Drawing statistics section, you can get a series of summary statistics of the past drawings, such as the most popular numbers and most popular Mega ball numbers. We also provide some visualization here. All these statistics might be helpful for you to choose a winning number.
In the Generate New Winning Numbers section, our app would generate a random number of Mega Millions based on the summary of all previous past drawings, which may slightly improve the winning drawing possibility. The users just need to enter the number of draws they wish to get and click submit, they can get the numbers generated by our app.

In the *Past Drawings* section, users can specify the start date and end date at the left panel and corresponding past drawings will be shown as a data table after the *Submit* button is clicked. The following figure shows drawing between 2022-12-01 and 2022-12-16.

Texas Lottery

Dashboard

Past Drawings

Lottery Statistics

Generate New Winning Numbers

Start Date

Year

Month

Day

2022

12

1

End Date

Year

Month

Day

2022

12

16

Submit

In this page, you can retrieve the records of past drawings from 2003 to 2022.

Show

25

entries

Search:

Date	Winning.Numbers	Mega.Ball	Megaplier	Estimated.Jackpot.MM	Jackpot.Winners	Detail
2022-12-16	8-35-40-53-56	11	3x	\$429 Million	Roll	Click me
2022-12-13	14-22-48-58-68	6	2x	\$400 Million	Roll	Click me
2022-12-09	8-19-53-61-69	19	4x	\$379 Million	Roll	Click me
2022-12-06	15-16-19-28-47	13	3x	\$354 Million	Roll	Click me
2022-12-02	1-21-36-46-52	16	3x	\$333 Million	Roll	Click me

Date

Winning.Numbers

Mega.Ball

Megaplier

Estimated.Jackpot.MM

Jackpot.Winners

Detail

Showing 1 to 5 of 5 entries

Previous

1

Next

Moreover, a modal dialogue will pop up if users click the button inside the Detail column. The modal dialogue presents users with detailed information on corresponding date and provides a web link to direct them to the original website if they would like to see more information.

Texas Lottery

Dashboard

Past Drawings

Lottery Statistics

Generate New Winning Numbers

Start Date

Year

Month

Day

2022

12

1

End Date

Year

Month

Day

2022

12

16

Submit

Detailed Information on 2022-12-16

Show

25

entries

Search:

Number.Correct	Prize.Amount	Total.Texas.Winners
5 of 5 w/Mega Ball	\$429 Million	Roll
5 of 5	\$1 Million	0
4 of 5 w/Mega Ball	\$10,000	1
4 of 5	\$500	32
3 of 5 w/Mega Ball	\$200	118
3 of 5	\$10	2,761
2 of 5 w/Mega Ball	\$10	2,586
1 of 5 w/Mega Ball	\$4	21,277
0 of 5 w/Mega Ball	\$2	53,373

Number.Correct

Prize.Amount

Total.Texas.Winners

Showing 1 to 9 of 9 entries

Previous

1

Next

Web Link : https://www.texaslottery.com/export/sites/lottery/Games/Mega_Millions/Winning_Numbers/details.html_1154708711.html

Cancel

As for the *Lottery statistics* section, users are allowed to select interested statistics and results will then be shown in the main panel. The statistics involve the most popular numbers, most popular Mega ball numbers and corresponding visualizations. As shown in the figure below, if the *Not Follow previous input* is not selected, the default statistics would correspond to the time range in the *Past Drawings* section. Otherwise, users can re-specify the start date and end date by clicking *Not Follow previous input* and the statistics will be re-calculated.

Texas Lottery

Dashboard

Past Drawings

Lottery Statistics

Generate New Winning Numbers

Page 2 content. This page has sidebar meny items that are used in the plot below.

Show

25

entries

Search:

Number	Drawn.Times	% of Drawing Numbers	% of Draws
17	190	1.91 %	9.57 %
14	186	1.87 %	9.37 %
31	185	1.86 %	9.32 %
20	183	1.84 %	9.21 %
10	181	1.82 %	9.11 %
25	179	1.8 %	9.01 %
48	178	1.79 %	8.96 %
38	177	1.78 %	8.91 %
46	177	1.78 %	8.91 %
24	173	1.74 %	8.71 %

Number

Drawn.Times

% of Drawing Numbers

% of Draws

Showing 1 to 10 of 10 entries

Previous

1

Next

In the *Generate New Winning Numbers* section, we generate new random numbers based on the amount of user input, and the probability of each number is slightly modified according to the previous results. We use drawings after 2018 since previous rules regarding range of numbers were different. If a number's frequency is below the first quantile (Q1), we decrease its probability by 20% while if a number's frequency is above the third quantile (Q3), we increase its probability by 20%. Based on this rule, we adjust the probability and generate the numbers randomly.

Texas Lottery

Dashboard

Past Drawings

Lottery Statistics

Generate New Winning Numbers

In this page, you can generate new potential winning numbers to buy your lotteries.

9 - 26 - 53 - 52 - 65 - 14

9 - 11 - 38 - 53 - 46 - 10

16 - 26 - 45 - 64 - 60 - 4

7 - 33 - 23 - 69 - 65 - 22

13 - 37 - 32 - 47 - 64 - 19

Discussion & Conclusions

In Nov 7th, 2022, the \$2.04 billion Powerball Jackpot found a winner at California. This massive prize is the world biggest lottery prize right now. If we pay more attention to the lottery field, we may find that in the past five years, there are 5 times that a lottery jackpot crossing the billion-dollar threshold. Motivated by these big amount of lottery jackpot, we wish to design an app to provide some basic information of one of the most famous lottery Mega Millions, retrieve previous drawing records, find related summary statistics, and generate random new numbers.

In our project, we find there is not obvious pattern of the most popular numbers or Megaball numbers, while sometimes certain number does have more appearance than others. Based on this, we could believe the winning number are randomly selected. In our generation of new number section, we based on the appearance percentage of numbers to adjust the probability that one number might be drawn. In our future job, we might add more kinds of lotteries, such as Powerball and so on into our app. In addition, we may continue to digging digger in the possibility that using machine learning to predict the winning numbers.

Reproducibility

We provide the following files:

`get_lottery.R`: the code for scraping the lottery data

`lottery.rds`: store the lottery data

`shinyapp.R`: the code for designing and running the shiny app

`project.Rmd`: all the write-up for the project

`dashboard.png`, `past.png`, `dialogue.png`, `statistics.png`, `new numbers.png`: images for illustrating the shiny app

Run the `get_lottery.R` to obtain the latest lottery data and the shiny app will be presented by running the `shinyapp.R`.

References

<https://www.megamillions.com/> https://en.wikipedia.org/wiki/Mega_Millions

https://www.texaslottery.com/export/sites/lottery/Games/Mega_Millions/index.html

<https://stackoverflow.com/questions/58821886/adding-buttons-to-shiny-dt-to-pull-up-modal>

<https://stackoverflow.com/questions/42047422/create-url-hyperlink-in-r-shiny>