Preamble

Title: Powerball Winners Data (2021)

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Introduction

This report analyses the Powerball winners numbers in 2020. Data for this report was obtained from information published by lotto.net.

Dataset

The dataset for this report was built from informaton published daily at Powerball Numbers from 2020. Web scraping techniques were employed to compile the winning numbers.

About Powerball: Powerball is an America lottery game in which a player picks 5 numbers from [1-69] and 1 number from [1-26] for a given drawing. They have options for powerplay which adds to the jackpot. The more numbers a player matches to the jackpot number, the bigger the payout.

I have chosen 2020 as the data to work with because it shows a complete picture of how the drawing pool looks like at the end of a year.

The script below automatically extracts Winning numbers. The information is saved in a json file (powerball_numbers_data.json) with the following structure:

```
[
  {"date": "December 30th 2020", "numbers": [3,43,45,61,65]},
  ...
  {"date": "January 1st 2020", "numbers": [49,53,57,59,62]}
]
```

```
1   # CS390Z - Introduction to Data Minining - Fall 2021
2   # Instructor: Thyago Mota
3   # Description: data collection
4   # Author: Ashish Acharya
5
6   from bs4 import BeautifulSoup
7   from google.colab import drive
```

```
from datetime import datetime, timedelta
import requests
import json
import time

# definitions/parameters
DATA_FOLDER = '/content/drive/MyDrive/Colab_Datasets/powerball_numbers_data/'
DATASET_NAME = 'powerball_numbers_data.json'
BASE_URL = 'https://www.lotto.net/powerball/numbers/2020'
HEADERS = {"User-Agent": "Mozilla/5.0 (X11; CrOS x86_64 12871.102.0) AppleWebKit/537
records = [] #dict for json dump
winning_numbers_list = []
# Google drive mount
# drive.mount('/content/drive')

result = requests.get(BASE_URL)
# 200 means its successful
if result.status_code == 200:
  soup = BeautifulSoup(result.content, 'html.parser')
  #to check if you actually got anything
  #print(soup)

  #the information for 1 drawing - 5 winning numbers & the powerball number
  # are stored in the results-vsmall archive list.
  # we find all of them and extract data from them
  divs = soup.find_all('div', class_="results-vsmall archive-list")
  for div in divs:
    #print to check what you are working with
    #print(div)

    #There is an unwanted information "Day", the day on which the numbers were drawn
    #we use extract to remove it and just get Month, Date and Year
    date = div.find('div', class_='date')
    unwanted = date.find('span')
    unwanted.extract()
    #there is a newline character before the date so we strip it
    date = date.text.strip()
    #print("Date:", date)

    #this holds the 5 winning numbers
    winning_numbers = div.find_all('li', class_='ball ball')

    #printing the 5 winning numbers
    for numbers in winning_numbers:
      winning_number = numbers.text
      winning_numbers_list.append(int(winning_number))
      #print("Winning Number:", winning_number)
    #print(winning_numbers_list)

    #printing the powerball number
    powerball_number = div.find('li', class_='ball power-play')
    span = powerball_number.find('span') #span holds the power ball number
```

```
    span = powerball_number.find('span') #span holds the power-ball number
    span = int(span.text)
    #print("Powerball Number:", span.text)

    #write numbers to dictionary
    records.append({'date': date, 'numbers': winning_numbers_list[0:6]})
    #powerball numbers have been ommitted since their range is 1-26
    #which would need a separate handling of their own
    #just need duplicate code to append numbers[6] separately in later parts
    #of the code for statistics and graph
    #records[date].append(span)

    #reset list
    winning_numbers_list.clear()


print(records)

with open(DATA_FOLDER + DATASET_NAME, 'w') as json_file:
   json.dump(records, json_file, ensure_ascii=False, indent=2)
```

```
[{'date': 'December 30th 2020', 'numbers': [3, 43, 45, 61, 65]}, {'date': 'December
```

Summary Statistics

```
# CS390Z - Introduction to Data Minining - Fall 2021
# Instructor: Thyago Mota
# Description: summary statistics

import json
from google.colab import drive
from datetime import datetime, timedelta
import numpy as np

# definitions/parameters
DATA_FOLDER = '/content/drive/MyDrive/Colab_Datasets/powerball_numbers_data/'
DATASET_NAME = 'powerball_numbers_data.json'

# Google drive mount
# drive.mount('/content/drive')

with open(DATA_FOLDER + DATASET_NAME, 'rt') as json_file:
  records = json.load(json_file)

numbers = []
for record in records:
  for num in record['numbers']:
```

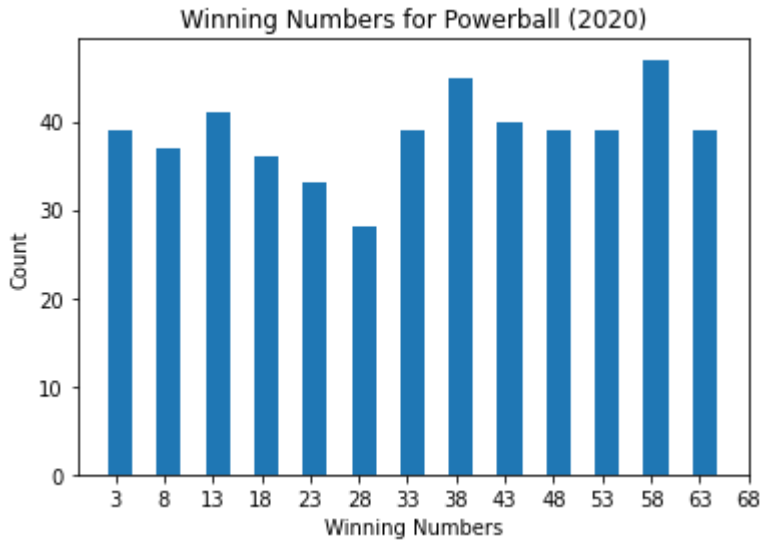
```
    numbers.append(num)
#print(numbers)
numbers_array = np.array(numbers)

print('*** Summary Statistics ***')
print(f'#records: {len(records)}')
# [1-69] is expected and it is what we get
print(f'Numbers range: [{np.min(numbers_array)},{np.max(numbers_array)}]')
print('Numbers mean: {:.2f}'.format(np.mean(numbers_array)))
print('Numbers median: {:.2f}'.format(np.median(numbers_array)))
print('Numbers std: {:.2f}'.format(np.std(numbers_array)))
```

```
*** Summary Statistics ***
#records: 105
Numbers range: [1,69]
Numbers mean: 35.25
Numbers median: 36.00
Numbers std: 19.92
```

Visualizations

```
# CS390Z - Introduction to Data Minining - Fall 2021
# Instructor: Thyago Mota
# Description: histogram

from google.colab import drive
import matplotlib.pyplot as plt

# definitions/parameters
DATA_FOLDER = '/content/drive/MyDrive/Colab_Datasets/powerball_numbers_data/'
DATASET_NAME = 'powerball_numbers_data.json'

# Google drive mount
# drive.mount('/content/drive')

with open(DATA_FOLDER + DATASET_NAME, 'rt') as json_file:
  records = json.load(json_file)

numbers·=·[]
for·record·in·records:
··for·num·in·record['numbers']:
····numbers.append(num)
#print(numbers)

bins·=·list(range(1,·69,·5))
counts,·bins,·_·=·plt.hist(
····numbers,·
····bins=bins,·
····rwidth=0.5
```

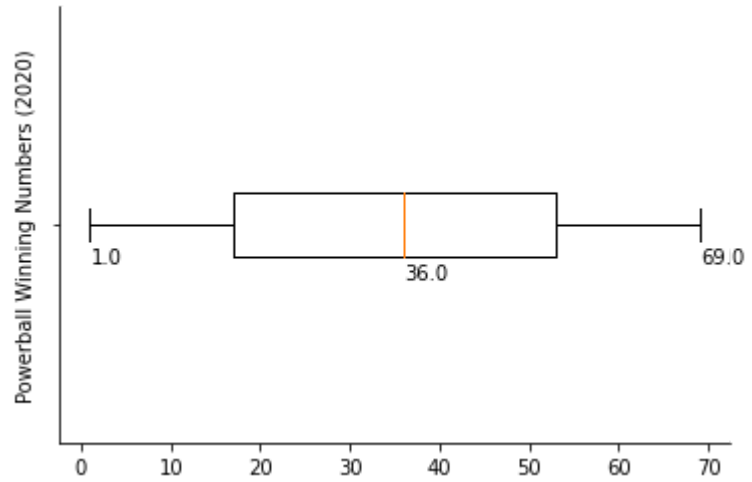
```
)
xticks·=·[x+2·for·x·in·bins]
axes·=·plt.gca()·#·get·a·reference·to·the·plot's·axes
axes.set_xticks(xticks)
plt.xlabel('Winning·Numbers')
plt.ylabel('Count')
plt.title('Winning·Numbers·for·Powerball·(2020)')
plt.show()
```




```
# CS390Z - Introduction to Data Minining - Fall 2021
# Instructor: Thyago Mota
# Description: box plot

from google.colab import drive
import matplotlib.pyplot as plt

# definitions/parameters
DATA_FOLDER = '/content/drive/MyDrive/Colab_Datasets/powerball_numbers_data/'
DATASET_NAME = 'powerball_numbers_data.json'

# Google drive mount
# drive.mount('/content/drive')

with open(DATA_FOLDER + DATASET_NAME, 'rt') as json_file:
  records = json.load(json_file)

numbers = []
for record in records:
  for num in record['numbers']:
    numbers.append(num)

bp = plt.boxplot(
    numbers,
    vert=False
)
for median in bp['medians']:
```

```
  for median in bp['medians']:
    xy = median.get_xydata()[0]
    xy[1] -= .05
    plt.annotate(str(xy[0]), xy=xy)

  for cap in bp['caps']:
    xy = cap.get_xydata()[0]
    xy[1] -= .05
    plt.annotate(str(xy[0]), xy=xy)

  min_whisker = bp['caps'][0].get_xydata()[0][0]
  max_whisker = bp['caps'][1].get_xydata()[0][0]

  outliers = []
  for record in records:
    for num in record['numbers']:
      if num < min_whisker or num > max_whisker:
        outliers.append(num)
  print('*** Outliers ***')
  for outlier in outliers:
    print(outlier)

  axes = plt.gca()
  axes.spines['right'].set_visible(False)
  axes.spines['top'].set_visible(False)
  axes.set_yticklabels([''])
  plt.ylabel('Powerball Winning Numbers (2020)')

  plt.show()
```

```
*** Outliers ***
```

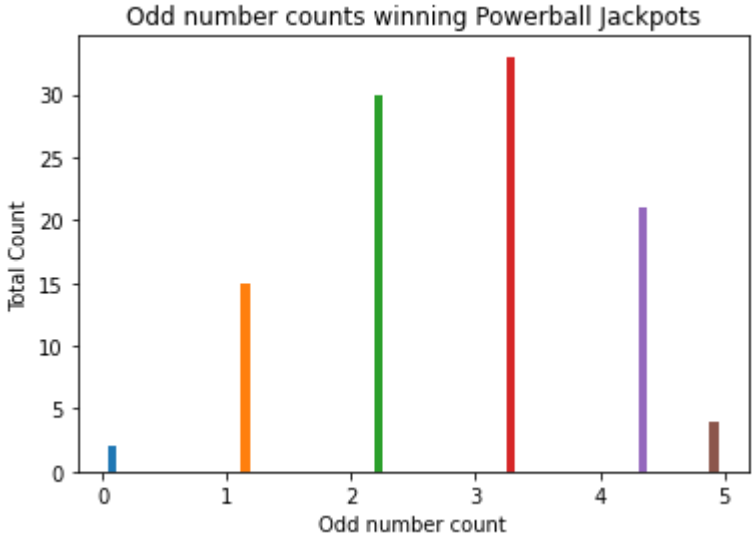



```
# CS390Z - Introduction to Data Minining - Fall 2021
# Instructor: Thyago Mota
# Description: time series

#Another interesting way to look at the data is counting how many even/odd
#numbers were there in a given winning drawing.
#Here we have a plot of winning number sets in which there were
```

```
#Here we have a plot of winning number sets in which there were
# 0 odd numbers, 1 odd numbers, .. all 5 odd numbers.

from google.colab import drive
import matplotlib.pyplot as plt
from datetime import datetime, timedelta

# definitions/parameters
DATA_FOLDER = '/content/drive/MyDrive/Colab_Datasets/powerball_numbers_data/'
DATASET_NAME = 'powerball_numbers_data.json'

# Google drive mount
# drive.mount('/content/drive')

with open(DATA_FOLDER + DATASET_NAME, 'rt') as json_file:
  records = json.load(json_file)

odd0 = 0
odd1 = 0
odd2 = 0
odd3 = 0
odd4 = 0
odd5 = 0

odd = 0
for record in records:
  for num in record['numbers']:
    if num % 2 == 1:
      odd += 1
  if odd == 0:
    odd0 += 1
  if odd  == 1:
    odd1 += 1
  if odd == 2:
    odd2 += 1
  if odd == 3:
    odd3 += 1
  if odd == 4:
    odd4 += 1
  if odd == 5:
    odd5+=1

  odd = 0

oddlist = []
oddlist.append([0]*odd0)
oddlist.append([1]*odd1)
oddlist.append([2]*odd2)
oddlist.append([3]*odd3)
oddlist.append([4]*odd4)
oddlist.append([5]*odd5)
#print(oddlist)
```

```
59
60  #verify that the sum of these match the total records
61  # print(odd0)
62  # print(odd1)
63  # print(odd2)
64  # print(odd3)
65  # print(odd4)
66  # print(odd5)
67
68  bins = list(range(0, 5))
69  counts, bins, _ = plt.hist(
70      oddlist
71  )
72
73  plt.xlabel('Odd number count')
74  plt.ylabel('Total Count')
75  plt.title('Odd number counts winning Powerball Jackpots')
76  plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83: VisibleDeprecatior
  return array(a, dtype, copy=False, order=order)
```



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