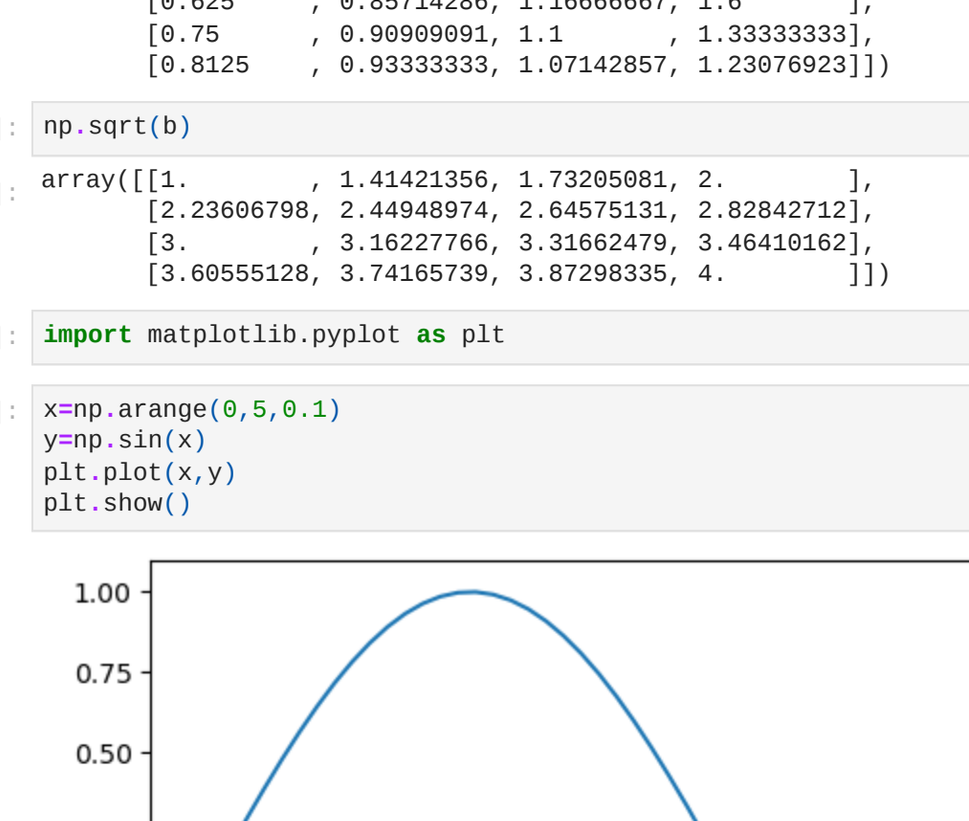
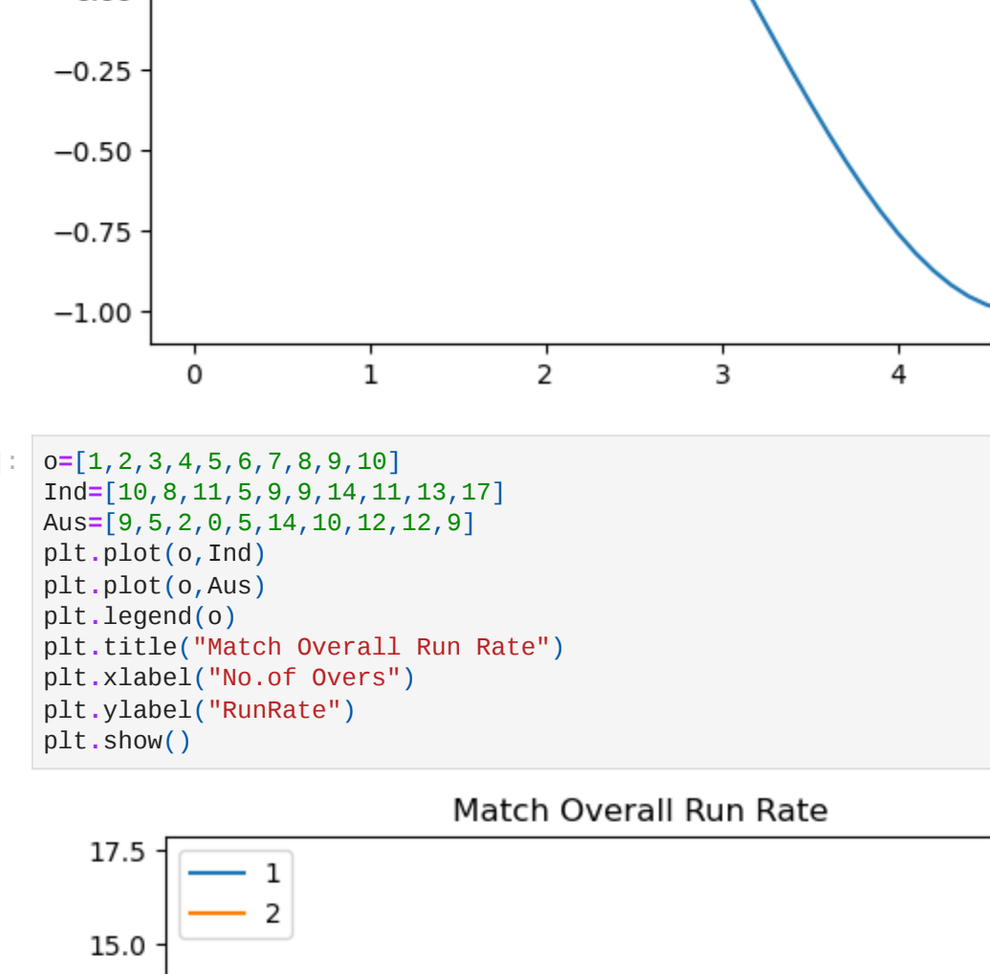
In [16]:
```
import numpy as np
a=np.array([[1,2,3,4],[5,6,7,8],[9,10,11,12],[13,14,15,16]])
print(a)
```
```
[[ 1  2  3  4]
 [ 5  6  7  8]
 [ 9 10 11 12]
 [13 14 15 16]]
```
In [17]:
```
b=a
```
In [18]:
```
print(b)
```
```
[[ 1  2  3  4]
 [ 5  6  7  8]
 [ 9 10 11 12]
 [13 14 15 16]]
```
In [19]:
```
print(a)
```
```
[[ 1  2  3  4]
 [ 5  6  7  8]
 [ 9 10 11 12]
 [13 14 15 16]]
```
In [20]:
```
c=np.array([[4,3,2,1],[8,7,6,5],[12,11,10,9],[16,15,14,13]])
print(c)
```
```
[[ 4  3  2  1]
 [ 8  7  6  5]
 [12 11 10  9]
 [16 15 14 13]]
```
In [ ]:

In [21]:
```
c.T
```
Out[21]:
```
array([[ 4,  8, 12, 16],
       [ 3,  7, 11, 15],
       [ 2,  6, 10, 14],
       [ 1,  5,  9, 13]])
```
In [22]:
```
c[:,1]
```
Out[22]:
```
array([ 3,  7, 11, 15])
```
In [23]:
```
b+c
```
Out[23]:
```
array([[ 5,  5,  5,  5],
       [13, 13, 13, 13],
       [21, 21, 21, 21],
       [29, 29, 29, 29]])
```
In [24]:
```
np.add(b,c)
```
Out[24]:
```
array([[ 5,  5,  5,  5],
       [13, 13, 13, 13],
       [21, 21, 21, 21],
       [29, 29, 29, 29]])
```
In [25]:
```
np.subtract(b,c)
```
Out[25]:
```
array([[-3, -1,  1,  3],
       [-3, -1,  1,  3],
       [-3, -1,  1,  3],
       [-3, -1,  1,  3]])
```
In [26]:
```
b-c
```
Out[26]:
```
array([[-3, -1,  1,  3],
       [-3, -1,  1,  3],
       [-3, -1,  1,  3],
       [-3, -1,  1,  3]])
```
In [27]:
```
b*c
```
Out[27]:
```
array([[  4,   6,   6,   4],
       [ 40,  42,  42,  40],
       [108, 110, 110, 108],
       [208, 210, 210, 208]])
```
In [29]:
```
np.multiply(b,c)
```
Out[29]:
```
array([[  4,   6,   6,   4],
       [ 40,  42,  42,  40],
       [108, 110, 110, 108],
       [208, 210, 210, 208]])
```
In [30]:
```
np.divide(b,c)
```
Out[30]:
```
array([[0.25      , 0.66666667, 1.5       , 4.        ],
       [0.625     , 0.85714286, 1.16666667, 1.6       ],
       [0.75      , 0.90909091, 1.1       , 1.33333333],
       [0.8125    , 0.93333333, 1.07142857, 1.23076923]])
```
In [31]:
```
b/c
```
Out[31]:
```
array([[0.25      , 0.66666667, 1.5       , 4.        ],
       [0.625     , 0.85714286, 1.16666667, 1.6       ],
       [0.75      , 0.90909091, 1.1       , 1.33333333],
       [0.8125    , 0.93333333, 1.07142857, 1.23076923]])
```
In [32]:
```
np.sqrt(b)
```
Out[32]:
```
array([[1.        , 1.41421356, 1.73205081, 2.        ],
       [2.23606798, 2.44948974, 2.64575131, 2.82842712],
       [3.        , 3.16227766, 3.31662479, 3.46410162],
       [3.60555128, 3.74165739, 3.87298335, 4.        ]])
```
In [33]:
```
import matplotlib.pyplot as plt
```
In [34]:
```
x=np.arange(0,5,0.1)
y=np.sin(x)
plt.plot(x,y)
plt.show()
```


In [52]:
```
o=[1,2,3,4,5,6,7,8,9,10]
Ind=[10,8,11,5,9,9,14,11,13,17]
Aus=[9,5,2,0,5,14,10,12,12,9]
plt.plot(o,Ind)
plt.plot(o,Aus)
plt.legend(o)
plt.title("Match Overall Run Rate")
plt.xlabel("No.of Overs")
plt.ylabel("RunRate")
plt.show()
```


In [46]:
```
import pandas as pd
```
In [55]:
```
ds=pd.read_csv("D:\president_heights.csv")
```
In [56]:
```
ds
```
Out[56]:

	order	name	height(cm)
0	1	George Washington	189
1	2	John Adams	170
2	3	Thomas Jefferson	189
3	4	James Madison	163
4	5	James Monroe	183
5	6	John Quincy Adams	171
6	7	Andrew Jackson	185
7	8	Martin Van Buren	168
8	9	William Henry Harrison	173
9	10	John Tyler	183
10	11	James K. Polk	173
11	12	Zachary Taylor	173
12	13	Millard Fillmore	175
13	14	Franklin Pierce	178
14	15	James Buchanan	183
15	16	Abraham Lincoln	193
16	17	Andrew Johnson	178
17	18	Ulysses S. Grant	173
18	19	Rutherford B. Hayes	174
19	20	James A. Garfield	183
20	21	Chester A. Arthur	183
21	23	Benjamin Harrison	168
22	25	William McKinley	170
23	26	Theodore Roosevelt	178
24	27	William Howard Taft	182
25	28	Woodrow Wilson	180
26	29	Warren G. Harding	183
27	30	Calvin Coolidge	178
28	31	Herbert Hoover	182
29	32	Franklin D. Roosevelt	188
30	33	Harry S. Truman	175
31	34	Dwight D. Eisenhower	179
32	35	John F. Kennedy	183
33	36	Lyndon B. Johnson	193
34	37	Richard Nixon	182
35	38	Gerald Ford	183
36	39	Jimmy Carter	177
37	40	Ronald Reagan	185
38	41	George H. W. Bush	188
39	42	Bill Clinton	188
40	43	George W. Bush	182
41	44	Barack Obama	185

In [58]:
```
ds.info()
```
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 42 entries, 0 to 41
Data columns (total 3 columns):
 #   Column      Non-Null Count  Dtype
---  ------      --------------  -----
 0   order       42 non-null     int64
 1   name        42 non-null     object
 2   height(cm)  42 non-null     int64
dtypes: int64(2), object(1)
memory usage: 1.1+ KB
```
In [59]:
```
ds.dtypes
```
Out[59]:
```
order          int64
name          object
height(cm)     int64
dtype: object
```
In [61]:
```
ds1=ds
```
In [62]:
```
ds
```
Out[62]:

	order	name	height(cm)
0	1	George Washington	189
1	2	John Adams	170
2	3	Thomas Jefferson	189
3	4	James Madison	163
4	5	James Monroe	183
5	6	John Quincy Adams	171
6	7	Andrew Jackson	185
7	8	Martin Van Buren	168
8	9	William Henry Harrison	173
9	10	John Tyler	183
10	11	James K. Polk	173
11	12	Zachary Taylor	173
12	13	Millard Fillmore	175
13	14	Franklin Pierce	178
14	15	James Buchanan	183
15	16	Abraham Lincoln	193
16	17	Andrew Johnson	178
17	18	Ulysses S. Grant	173
18	19	Rutherford B. Hayes	174
19	20	James A. Garfield	183
20	21	Chester A. Arthur	183
21	23	Benjamin Harrison	168
22	25	William McKinley	170
23	26	Theodore Roosevelt	178
24	27	William Howard Taft	182
25	28	Woodrow Wilson	180
26	29	Warren G. Harding	183
27	30	Calvin Coolidge	178
28	31	Herbert Hoover	182
29	32	Franklin D. Roosevelt	188
30	33	Harry S. Truman	175
31	34	Dwight D. Eisenhower	179
32	35	John F. Kennedy	183
33	36	Lyndon B. Johnson	193
34	37	Richard Nixon	182
35	38	Gerald Ford	183
36	39	Jimmy Carter	177
37	40	Ronald Reagan	185
38	41	George H. W. Bush	188
39	42	Bill Clinton	188
40	43	George W. Bush	182
41	44	Barack Obama	185

In [67]:
```
ds1.head(10)
```
Out[67]:

	order	name	height(cm)
0	1	George Washington	189
1	2	John Adams	170
2	3	Thomas Jefferson	189
3	4	James Madison	163
4	5	James Monroe	183
5	6	John Quincy Adams	171
6	7	Andrew Jackson	185
7	8	Martin Van Buren	168
8	9	William Henry Harrison	173
9	10	John Tyler	183

In [68]:
```
ds1.tail()
```
Out[68]:

	order	name	height(cm)
37	40	Ronald Reagan	185
38	41	George H. W. Bush	188
39	42	Bill Clinton	188
40	43	George W. Bush	182
41	44	Barack Obama	185

In [58]:
```
ds1.head(1)
```
Out[68]:

	order	name	height(cm)
0	1	George Washington	189

In [69]:
```
ds1.iloc[35]
```
Out[69]:
```
order                  38
name          Gerald Ford
height(cm)            183
Name: 35, dtype: object
```
In [73]:
```
ds1.iloc[35:39]
```
Out[73]:

	order	name	height(cm)
35	38	Gerald Ford	183
36	39	Jimmy Carter	177
37	40	Ronald Reagan	185
38	41	George H. W. Bush	188

In [74]:
```
ds1.describe()
```
Out[74]:

	order	height(cm)
count	42.000000	42.000000
mean	22.476190	179.738095
std	13.152461	7.015869
min	1.000000	163.000000
25%	11.250000	174.250000
50%	22.000000	182.000000
75%	33.750000	183.000000
max	44.000000	193.000000

In [81]:
```
ds1['order'].describe()
```
Out[81]:
```
count    42.000000
mean     22.476190
std      13.152461
min       1.000000
25%      11.250000
50%      22.000000
75%      33.750000
max      44.000000
Name: order, dtype: float64
```
In [82]:
```
subset=ds1[['order','name']]
```
In [84]:
```
subset
```
Out[84]:

	order	name
0	1	George Washington
1	2	John Adams
2	3	Thomas Jefferson
3	4	James Madison
4	5	James Monroe
5	6	John Quincy Adams
6	7	Andrew Jackson
7	8	Martin Van Buren
8	9	William Henry Harrison
9	10	John Tyler
10	11	James K. Polk
11	12	Zachary Taylor
12	13	Millard Fillmore
13	14	Franklin Pierce
14	15	James Buchanan
15	16	Abraham Lincoln
16	17	Andrew Johnson
17	18	Ulysses S. Grant
18	19	Rutherford B. Hayes
19	20	James A. Garfield
20	21	Chester A. Arthur
21	23	Benjamin Harrison
22	25	William McKinley
23	26	Theodore Roosevelt
24	27	William Howard Taft
25	28	Woodrow Wilson
26	29	Warren G. Harding
27	30	Calvin Coolidge
28	31	Herbert Hoover
29	32	Franklin D. Roosevelt
30	33	Harry S. Truman
31	34	Dwight D. Eisenhower
32	35	John F. Kennedy
33	36	Lyndon B. Johnson
34	37	Richard Nixon
35	38	Gerald Ford
36	39	Jimmy Carter
37	40	Ronald Reagan
38	41	George H. W. Bush
39	42	Bill Clinton
40	43	George W. Bush
41	44	Barack Obama

In [85]:
```
del subset['order']
```
In [86]:
```
subset
```
Out[86]:

	name
0	George Washington
1	John Adams
2	Thomas Jefferson
3	James Madison
4	James Monroe
5	John Quincy Adams
6	Andrew Jackson
7	Martin Van Buren
8	William Henry Harrison
9	John Tyler
10	James K. Polk
11	Zachary Taylor
12	Millard Fillmore
13	Franklin Pierce
14	James Buchanan
15	Abraham Lincoln
16	Andrew Johnson
17	Ulysses S. Grant
18	Rutherford B. Hayes
19	James A. Garfield
20	Chester A. Arthur
21	Benjamin Harrison
22	William McKinley
23	Theodore Roosevelt
24	William Howard Taft
25	Woodrow Wilson
26	Warren G. Harding
27	Calvin Coolidge
28	Herbert Hoover
29	Franklin D. Roosevelt
30	Harry S. Truman
31	Dwight D. Eisenhower
32	John F. Kennedy
33	Lyndon B. Johnson
34	Richard Nixon
35	Gerald Ford
36	Jimmy Carter
37	Ronald Reagan
38	George H. W. Bush
39	Bill Clinton
40	George W. Bush
41	Barack Obama

In [87]:
```
ds1.rename(columns={'order':'ordernumber'})
```
Out[87]:

	ordernumber	name	height(cm)
0	1	George Washington	189
1	2	John Adams	170
2	3	Thomas Jefferson	189
3	4	James Madison	163
4	5	James Monroe	183
5	6	John Quincy Adams	171
6	7	Andrew Jackson	185
7	8	Martin Van Buren	168
8	9	William Henry Harrison	173
9	10	John Tyler	183
10	11	James K. Polk	173
11	12	Zachary Taylor	173
12	13	Millard Fillmore	175
13	14	Franklin Pierce	178
14	15	James Buchanan	183
15	16	Abraham Lincoln	193
16	17	Andrew Johnson	178
17	18	Ulysses S. Grant	173
18	19	Rutherford B. Hayes	174
19	20	James A. Garfield	183
20	21	Chester A. Arthur	183
21	23	Benjamin Harrison	168
22	25	William McKinley	170
23	26	Theodore Roosevelt	178
24	27	William Howard Taft	182
25	28	Woodrow Wilson	180
26	29	Warren G. Harding	183
27	30	Calvin Coolidge	178
28	31	Herbert Hoover	182
29	32	Franklin D. Roosevelt	188
30	33	Harry S. Truman	175
31	34	Dwight D. Eisenhower	179
32	35	John F. Kennedy	183
33	36	Lyndon B. Johnson	193
34	37	Richard Nixon	182
35	38	Gerald Ford	183
36	39	Jimmy Carter	177
37	40	Ronald Reagan	185
38	41	George H. W. Bush	188
39	42	Bill Clinton	188
40	43	George W. Bush	182
41	44	Barack Obama	185

In [88]:
```
ds1.columns
```
Out[88]:
```
Index(['order', 'name', 'height(cm)'], dtype='object')
```
In [89]:
```
ds1
```
Out[89]:

	order	name	height(cm)
0	1	George Washington	189
1	2	John Adams	170
2	3	Thomas Jefferson	189
3	4	James Madison	163
4	5	James Monroe	183
5	6	John Quincy Adams	171
6	7	Andrew Jackson	185
7	8	Martin Van Buren	168
8	9	William Henry Harrison	173
9	10	John Tyler	183
10	11	James K. Polk	173
11	12	Zachary Taylor	173
12	13	Millard Fillmore	175
13	14	Franklin Pierce	178
14	15	James Buchanan	183
15	16	Abraham Lincoln	193
16	17	Andrew Johnson	178
17	18	Ulysses S. Grant	173
18	19	Rutherford B. Hayes	174
19	20	James A. Garfield	183
20	21	Chester A. Arthur	183
21	23	Benjamin Harrison	168
22	25	William McKinley	170
23	26	Theodore Roosevelt	178
24	27	William Howard Taft	182
25	28	Woodrow Wilson	180
26	29	Warren G. Harding	183
27	30	Calvin Coolidge	178
28	31	Herbert Hoover	182
29	32	Franklin D. Roosevelt	188
30	33	Harry S. Truman	175
31	34	Dwight D. Eisenhower	179
32	35	John F. Kennedy	183
33	36	Lyndon B. Johnson	193
34	37	Richard Nixon	182
35	38	Gerald Ford	183
36	39	Jimmy Carter	177
37	40	Ronald Reagan	185
38	41	George H. W. Bush	188
39	42	Bill Clinton	188
40	43	George W. Bush	182
41	44	Barack Obama	185

In [91]:
```
ds1.insert(7,"8","Dr.Nihanth the Emperor","176")
```
```
---------------------------------------------------------------------------
IndexError                                Traceback (most recent call last)
~\AppData\Local\Temp\ipykernel_7468\3388974678.py in <module>
----> 1 ds1.insert(7,"8","Dr.Nihanth the Emperor","176")

~\anaconda3\lib\site-packages\pandas\core\frame.py in insert(self, loc, column, value, allow_duplicates)
   4446
   4447         value = self._sanitize_column(value)
-> 4448         self._mgr.insert(loc, column, value)
   4449
   4450     def assign(self, **kwargs) -> DataFrame:

~\anaconda3\lib\site-packages\pandas\core\internals\managers.py in insert(self, loc, item, value)
   1238         """
   1239         # insert to the axis; this could possibly raise a TypeError
-> 1240         new_axis = self.items.insert(loc, item)
   1241
   1242         if value.ndim == 2:

~\anaconda3\lib\site-packages\pandas\core\indexes\base.py in insert(self, loc, item)
   6614             # special-casing dt64/td64 https://github.com/numpy/numpy/issues/12550
   6615             casted = arr.dtype.type(item)
-> 6616             new_values = np.insert(arr, loc, casted)
   6617
   6618         else:

<__array_function__ internals> in insert(*args, **kwargs)

~\anaconda3\lib\site-packages\numpy\lib\function_base.py in insert(arr, obj, values, axis)
   4702         index = indices.item()
   4703         if index < -N or index >= N:
-> 4704             raise IndexError(
   4705                 "index %i is out of bounds for axis %i with "
   4706                 "size %i" % (obj, axis, N))

IndexError: index 7 is out of bounds for axis 0 with size 3
```
In [93]:
```
ds1=ds
ds1.iloc[4]
```
Out[93]:
```
order                   5
name         James Monroe
height(cm)            183
Name: 4, dtype: object
```
In [94]:
```
ds1.iloc[4]=5,"Nihanth","176"
```
In [95]:
```
ds1.iloc[4]
```
Out[95]:
```
order               5
name          Nihanth
height(cm)        176
Name: 4, dtype: object
```
In [99]:
```
del ds1["order"]
```
In [100]:
```
ds1
```
Out[100]:

	name	height(cm)
0	George Washington	189
1	John Adams	170
2	Thomas Jefferson	189
3	James Madison	163
4	Nihanth	176
5	John Quincy Adams	171
6	Andrew Jackson	185
7	Martin Van Buren	168
8	William Henry Harrison	173
9	John Tyler	183
10	James K. Polk	173
11	Zachary Taylor	173
12	Millard Fillmore	175
13	Franklin Pierce	178
14	James Buchanan	183
15	Abraham Lincoln	193
16	Andrew Johnson	178
17	Ulysses S. Grant	173
18	Rutherford B. Hayes	174
19	James A. Garfield	183
20	Chester A. Arthur	183
21	Benjamin Harrison	168
22	William McKinley	170
23	Theodore Roosevelt	178
24	William Howard Taft	182
25	Woodrow Wilson	180
26	Warren G. Harding	183
27	Calvin Coolidge	178
28	Herbert Hoover	182
29	Franklin D. Roosevelt	188
30	Harry S. Truman	175
31	Dwight D. Eisenhower	179
32	John F. Kennedy	183
33	Lyndon B. Johnson	193
34	Richard Nixon	182
35	Gerald Ford	183
36	Jimmy Carter	177
37	Ronald Reagan	185
38	George H. W. Bush	188
39	Bill Clinton	188
40	George W. Bush	182
41	Barack Obama	185

In [ ]: