eda

March 20, 2020

[1]:

```
import numpy as np
from typing import List, Tuple
import pandas as pd
from matplotlib import pyplot as plt
%matplotlib inline
import matplotlib as mpl
mpl.rcParams['figure.dpi']= 120
import os
import seaborn as sns
sns.set(style="whitegrid")

img_dir = 'images'
```

[2]:

```
data_path = '/home/tjy/repos/red-bag-data/all-csv/'

data_files = []
filenames = os.listdir(data_path)
for f in filenames:
    if '.csv' in f:
        data_files.append(os.path.join(data_path, f))

dfs: List[pd.DataFrame] = [pd.read_csv(f) for f in data_files]
dfs[0]
```

[2]:

```
   order  value
0      0   1.23
1      1   6.29
2      2  12.43
3      3   4.13
4      4   1.10
5      5   0.81
6      6   4.73
7      7  10.97
8      8  12.90
9      9  11.41
```

[3]:

```python
data_df = []

for i in range(len(dfs)):
    df = dfs[i].values
    df = np.hstack([df, np.ones((10, 1)) * i])
    data_df.append(df)

data_df = np.vstack(data_df)
data_df = pd.DataFrame(data_df, columns=['order', 'money', 'trial'])
data_df.to_csv('data_df.csv')
```

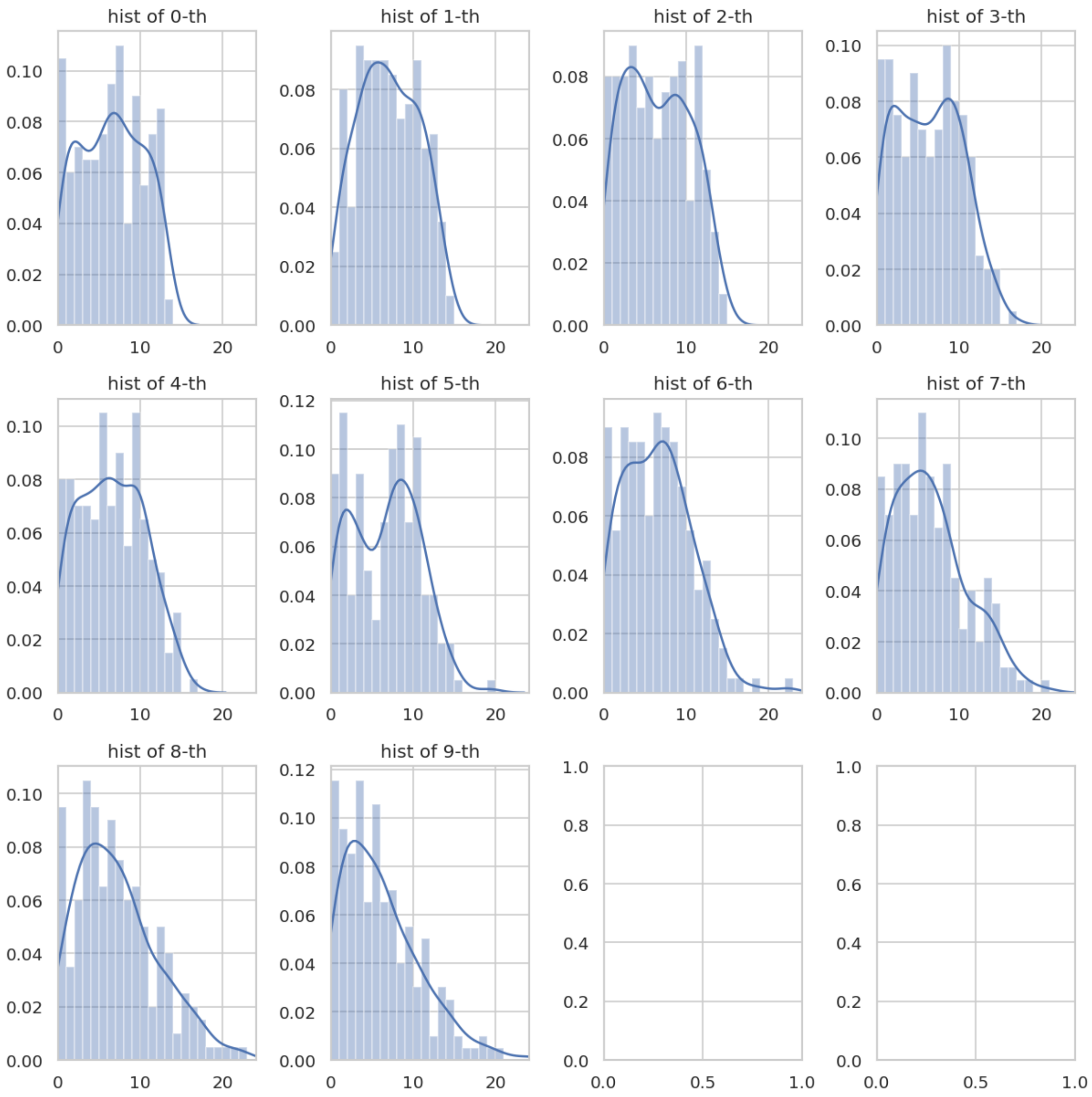
[4]:

```python
n_trials = len(dfs)
data_dict = {'order': [i for i in range(10)]}

for i in range(n_trials):
    data_dict['trial_{}'.format(i)] = dfs[i]['value'].tolist()
data = pd.DataFrame(data_dict)
data.set_index('order', inplace=True)
np.savetxt('trials.csv', data.values)
# data
```

1 histogram

[5]:

```python
def plot_hist_for_players(data1, bin_size: float = 1.0):
    fig, axs = plt.subplots(3, 4)
    fig.set_size_inches(10.24, 10.24)
    axs = axs.flat
    xlim = np.max(data1.money)
    bins = np.arange(0.0, xlim + 0.1, step=bin_size)
    for i in range(10):
        _data1 = data1[data1.order == i].money.values
        sns.distplot(_data1, bins=bins, label="true data", ax=axs[i])
        axs[i].set_title('hist of {}-th'.format(i))
        axs[i].set_xlim([0, xlim])
    # axs[0].legend()
    fig.tight_layout()
    plt.savefig(os.path.join(img_dir, "distribution-true.png"))
    plt.show()

plot_hist_for_players(data_df)
```



2 Data profile

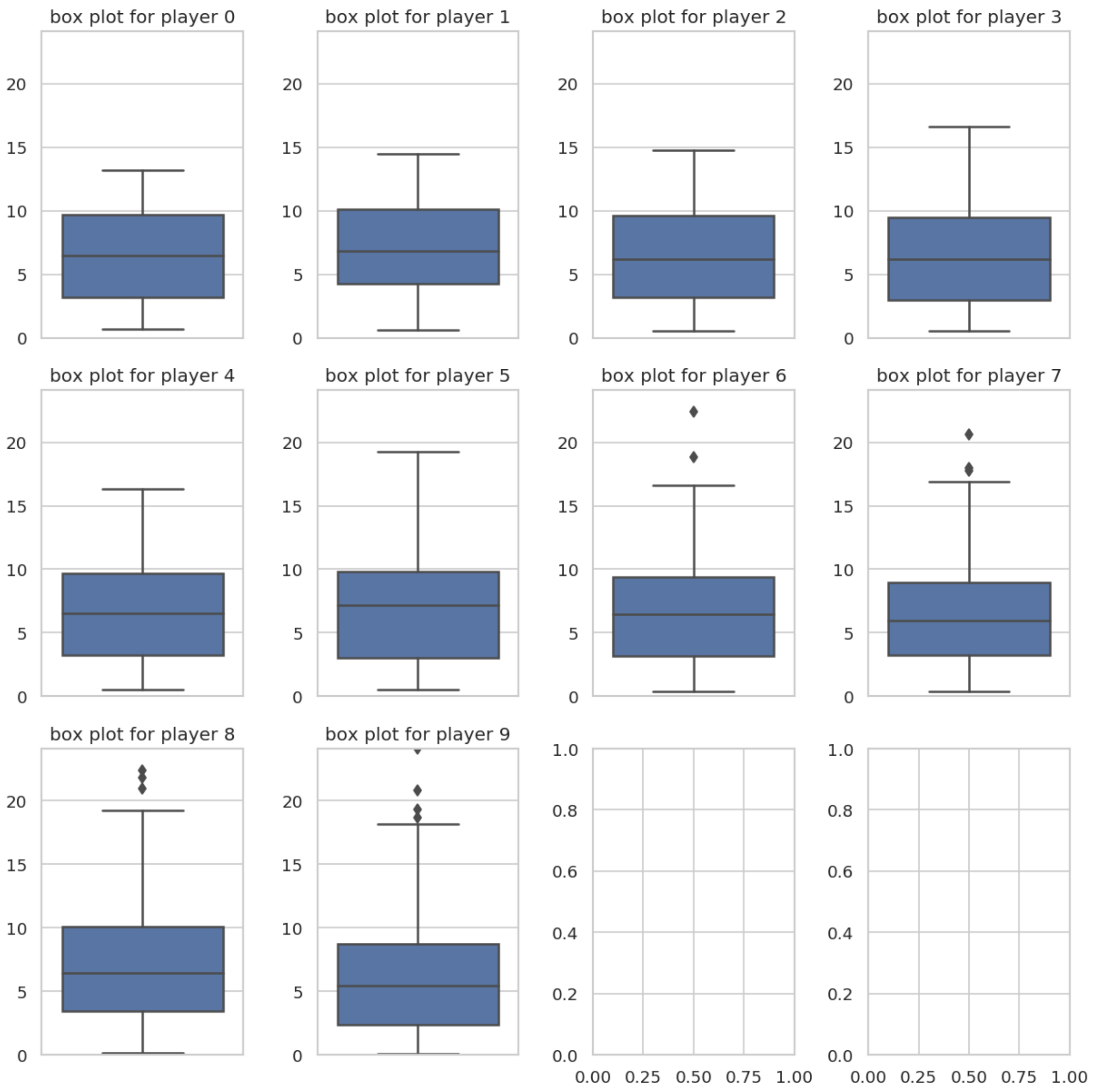
[14]:
```
pd.DataFrame(data.T).describe()
```

[14]:
```
order           0           1           2           3         4           5  \
count  200.000000  200.000000  200.000000  200.000000  200.0000  200.000000
mean     6.524450    7.014650    6.517550    6.357850    6.5826    6.618050
std      3.823247    3.621468    3.894147    3.932249    3.9002    4.075096
min      0.660000    0.620000    0.550000    0.540000    0.5200    0.500000
25%      3.212500    4.232500    3.210000    2.942500    3.2550    3.047500
50%      6.510000    6.860000    6.175000    6.220000    6.5250    7.170000
75%      9.662500   10.137500    9.615000    9.442500    9.6875    9.802500
```

```
max     13.170000   14.490000   14.760000   16.630000   16.3300   19.270000

order           6           7           8           9
count  200.000000  200.000000  200.000000  200.000000
mean     6.516000    6.564750    7.223750    6.080350
std      4.089039    4.345045    4.875636    4.690813
min      0.420000    0.360000    0.190000    0.050000
25%      3.187500    3.275000    3.470000    2.350000
50%      6.465000    5.935000    6.460000    5.455000
75%      9.367500    8.975000   10.062500    8.742500
max     22.400000   20.580000   22.370000   24.100000
```

[7]:

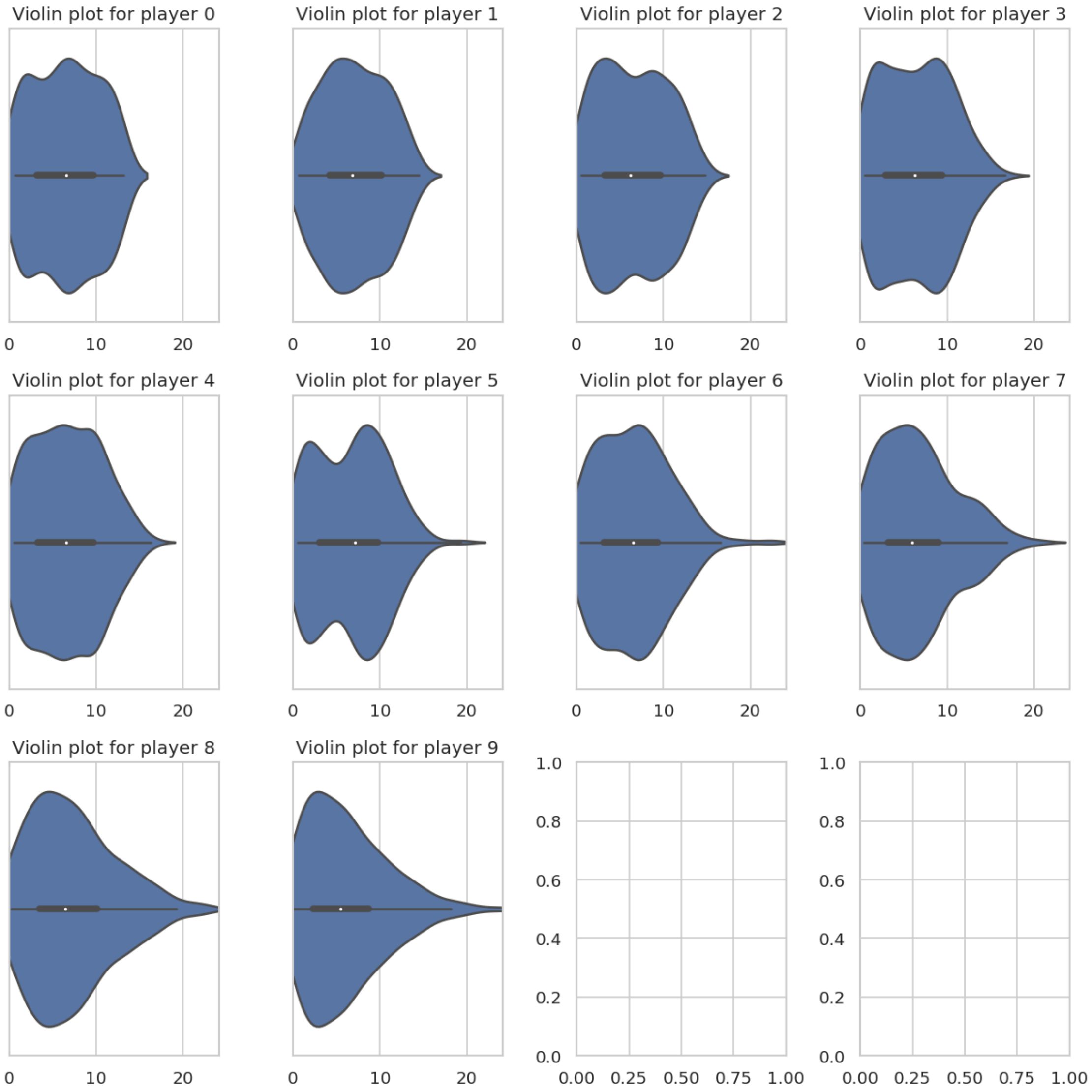
```
def boxplot(data: pd.DataFrame, plot_name):
    fig, axs = plt.subplots(3, 4)
    fig.set_size_inches(10.24, 10.24)
    axs = axs.flat
    ylim = np.max(data.values)
    for i in range(10):
        sns.boxplot(data.values[i,], ax=axs[i], orient='v')
        title = 'box plot for player {}'.format(i)
        axs[i].set_title(title)
        axs[i].set_ylim([0, ylim])
    fig.tight_layout()
    plt.savefig(os.path.join(img_dir, 'box-plot-{}.png'.format(plot_name)))
    plt.show()

boxplot(data, 'true-data')
```



[8]:

```
def violinplot(data: pd.DataFrame, plot_name):
    fig, axs = plt.subplots(3, 4)
    fig.set_size_inches(10.24, 10.24)
    axs = axs.flat
    lim = np.max(data.values)
    for i in range(10):
        sns.violinplot(data.values[i,], ax=axs[i])
        title = 'Violin plot for player {}'.format(i)
        axs[i].set_title(title)
        axs[i].set_xlim([0, lim])
    fig.tight_layout()
    plt.savefig(os.path.join(img_dir, 'violin-plot-{}.png'.format(plot_name)))
    plt.show()
```

```
violinplot(data, 'true-data')
```



3 Luckiest Players & Least Lucky Players

```
[9]: def plot_lucky_n_unlucky_players(data_lucky: pd.DataFrame, data_unlucky: pd.
     ↪DataFrame, bar_width: float = 0.35):
         labels = [str(i) for i in range(10)]
         lucky = data_lucky.values.flatten().tolist()
         unlucky = data_unlucky.values.flatten().tolist()
         fig, ax = plt.subplots()
         ax.bar(labels, lucky, width=bar_width, label='Lucky')
```

```
    ax.bar(labels, unlucky, width=bar_width, bottom=lucky,
           label='Unlucky')
    ax.set_ylabel('Frequency')
    ax.set_xlabel('Player order')
    ax.set_title('Count of luckiest and unluckiest players')
    ax.legend()
    plt.show()

# plot_lucky_n_unlucky_players(luckiest_player, unluckiest_player)
```

[15]:

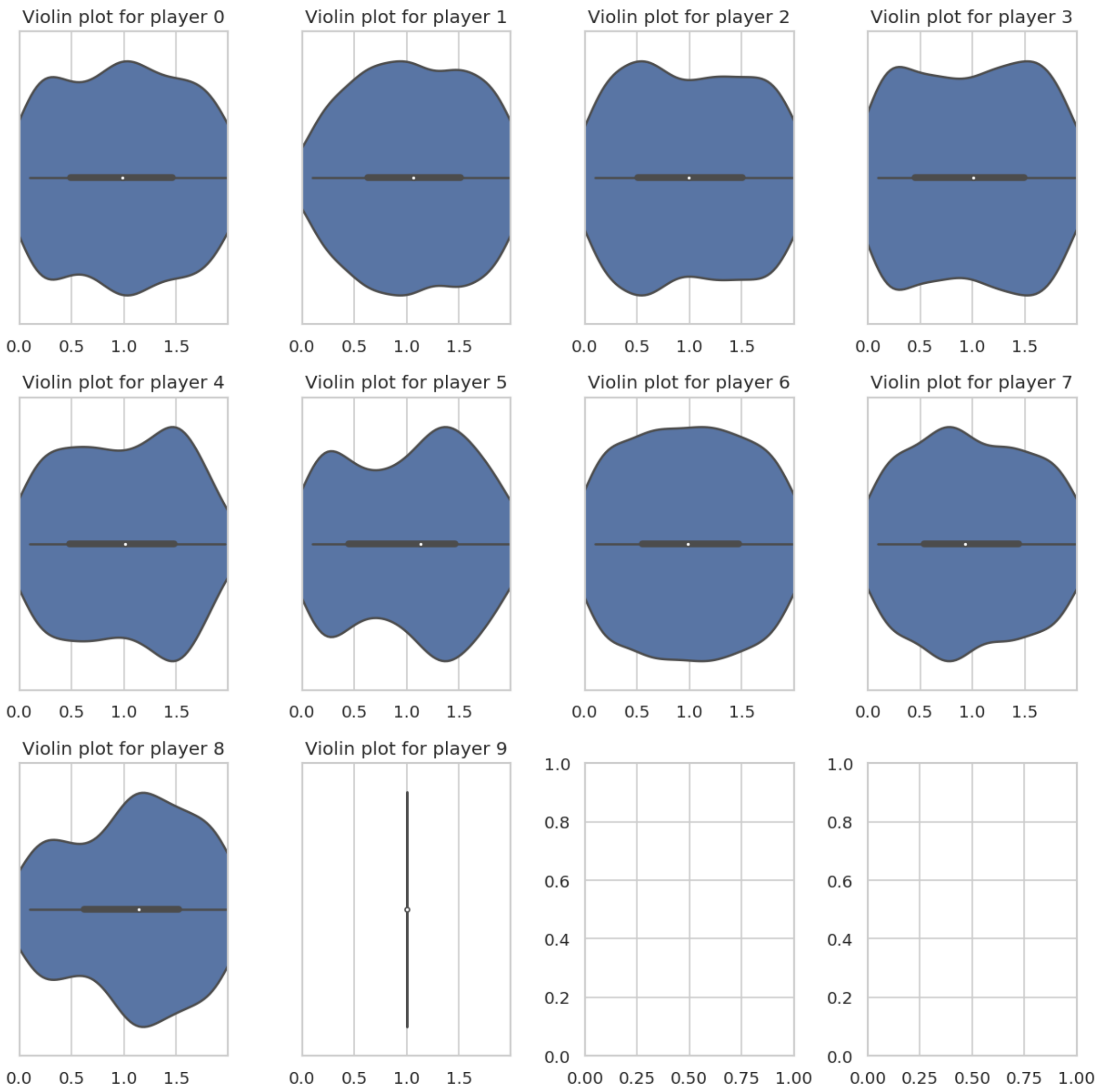
```
def remain_average(data: pd.DataFrame, money=66.0, n_trials=200):
    data = data.values
    data_cumsum = np.cumsum(data, axis=0)
    data_cumsum = np.vstack([np.zeros((1, n_trials)), data_cumsum[:-1]])
    remaining = money - data_cumsum
    remain_n_players = np.arange(1, 11)[::-1].reshape(10, 1)
    remain_n_players = np.repeat(remain_n_players, n_trials, axis=1)
    remaining /= remain_n_players # no need for the last player
    k = data / remaining
    return k

k = remain_average(data)
k_df = pd.DataFrame(k[:-1].flatten())
k_df.describe()
```

[15]:

```
                 0
count  1800.000000
mean      1.008518
std       0.567789
min       0.097968
25%       0.524374
50%       1.032778
75%       1.486377
max       1.997090
```

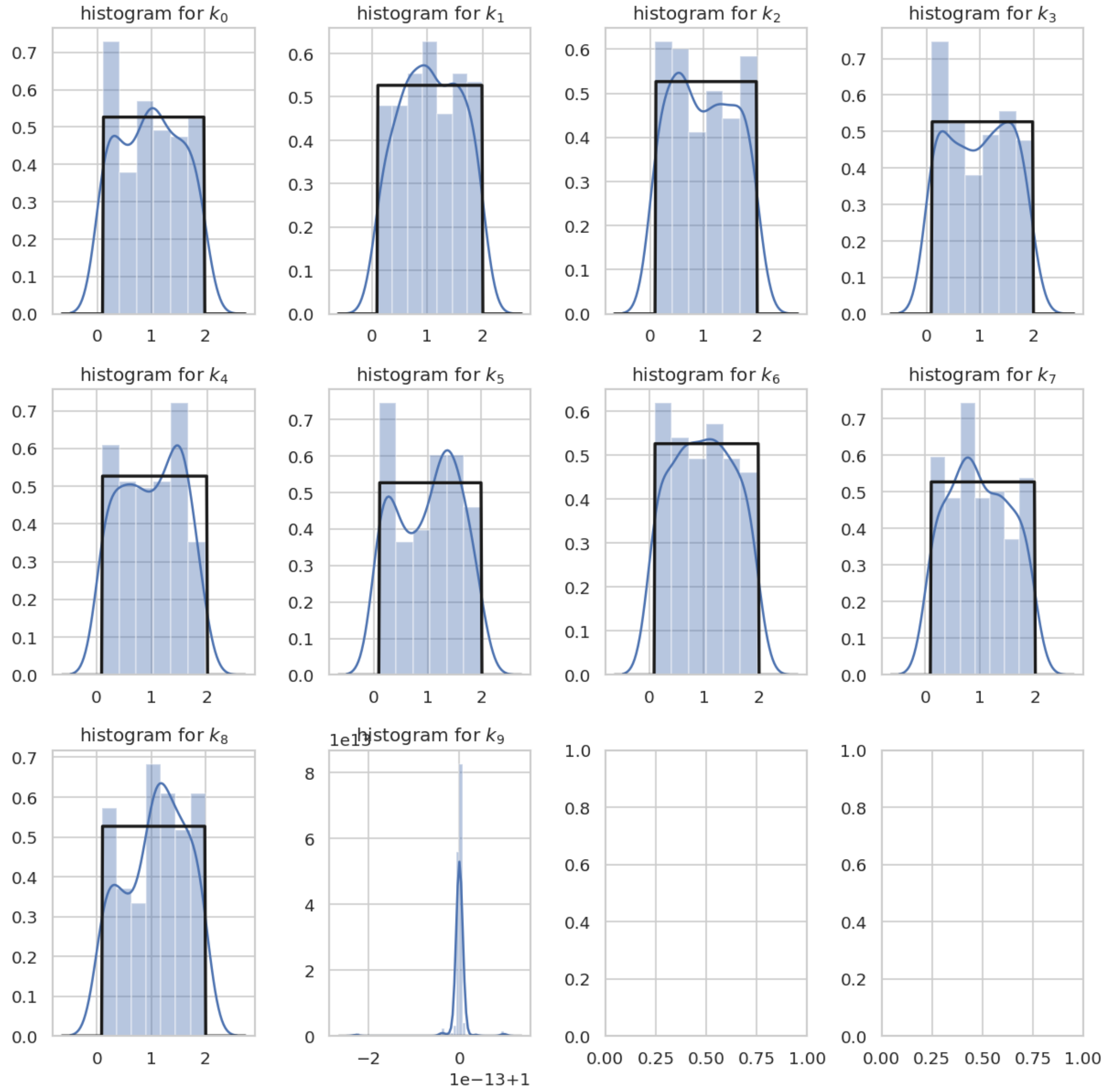
[11]:

```
k_data = pd.DataFrame(k)
violinplot(k_data, 'k')
```



[12]:

```
from scipy.stats import uniform

def plot_dists_fit(data: np.ndarray, dist=uniform):
    fig, axs = plt.subplots(3, 4)
    fig.set_size_inches(10.24, 10.24)
    axs = axs.flat
    d = dist.fit(data.flatten())
    for i in range(10):
        sns.distplot(data[i,], ax=axs[i])
        title = 'histogram for $k_{}$'.format(i)
        axs[i].set_title(title)
        # plot the PDF
        xmin, xmax = axs[i].get_xlim()
        x = np.linspace(xmin, xmax, data.shape[1])
        p = dist.pdf(x, *d)
        axs[i].plot(x, p, 'k', linewidth=2)
    fig.tight_layout()
    plt.savefig(os.path.join(img_dir, 'k-histogram.png'))
    plt.show()
    return d

plot_dists_fit(k)
```



```
[12]: (0.09796806966618292, 1.899122282554338)
```

```
[12]:
```