Homework 4

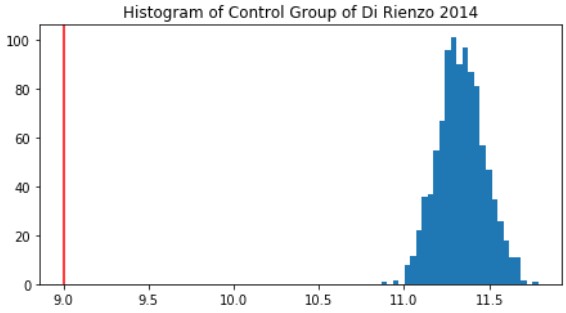
In [2]:
```
# import libraries
import numpy as np
from scipy import stats
import matplotlib.pyplot as plt
```

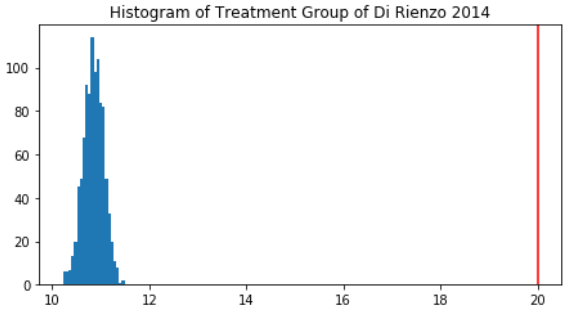
In [4]:
```
a_control = 108
b_control = 35
a_treatment = 58
b_treatment = 65

# create posterior distribution
posterior_control = stats.beta(a_control, b_control)
posterior_treatment = stats.beta(a_treatment, b_treatment)
```

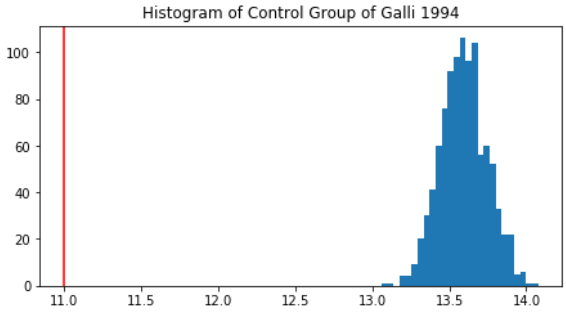
In [9]:
```
dataset = {
    "Di Rienzo 2014": {"control": [9, 15], "treatment": [20, 23]},
    "Galli 1994": {"control": [11, 18], "treatment": [10, 16]},
    "Kaufman 1974": {"control": [4, 10], "treatment": [13, 16]},
    "Qin 2014": {"control": [21, 39], "treatment": [35, 45]},
    "Sanchez 2012": {"control": [12, 29], "treatment": [22, 31]},
    "Silny 2006": {"control": [0, 10], "treatment": [7, 10]}
}
```

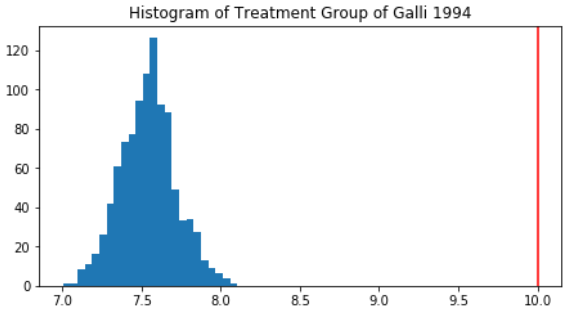
In [30]:
```
count = 1
plt.rcParams['figure.figsize'] = [16, 26]

for key, data in dataset.items():

    s_control = data["control"][0]
    n_control = data["control"][1]
    s_treatment = data["treatment"][0]
    n_treatment = data["treatment"][1]
    rvs_control = []
    rvs_treatment = []
    p_value_control = []
    p_value_treatment = []
    for i in range(1000):
        pc_sample = sum(posterior_control.rvs(size=n_control))
        z_score = (pc_sample - s_control) / (s_control*(n_control-s_cont
rol) / n_control)**0.5
        p_value_control.append(stats.norm.sf(abs(z_score)))
        rvs_control.append(pc_sample)

        pt_sample = sum(posterior_treatment.rvs(size=n_treatment))
        z_score = (pt_sample - s_treatment) / (s_treatment*(n_treatment-
s_treatment) / n_treatment)**0.5
        p_value_treatment.append(stats.norm.sf(abs(z_score)))
        rvs_treatment.append(pt_sample)

    p_value_control = sum(p_value_control)/len(p_value_control)
    p_value_treatment = sum(p_value_treatment)/len(p_value_treatment)
    print ("For {:s}, the average p-value of control group is {:.2f} of
 treatment group is {:.2f}"
           .format(key, p_value_control, p_value_treatment))

    plt.subplot(6, 2, count)
    plt.hist(rvs_control, bins='auto')  # histogram showing the control
 group posterior sample distribution
    plt.axvline(s_control, color='r')  # vertical line showing the actua
l success of the control group
    plt.title("Histogram of Control Group of {:s}".format(key))
    count +=1

    plt.subplot(6, 2, count)
    plt.hist(rvs_treatment, bins='auto')  # histogram showing the treatm
ent group posterior sample distribution
    plt.axvline(s_treatment, color='r')  # vertical line showing the act
ual success of the treatment group
    plt.title("Histogram of Treatment Group of {:s}".format(key))
    count +=1

plt.show()
```

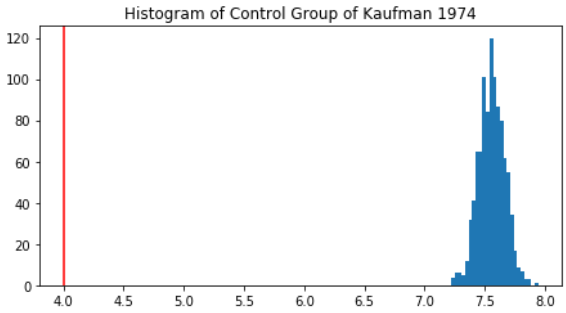
```
For Di Rienzo 2014, the average p-value of control group is 0.11 of tre
atment group is 0.00
For Galli 1994, the average p-value of control group is 0.11 of treatme
nt group is 0.10
For Kaufman 1974, the average p-value of control group is 0.01 of treat
ment group is 0.00
For Qin 2014, the average p-value of control group is 0.00 of treatment
group is 0.00
For Sanchez 2012, the average p-value of control group is 0.00 of treat
ment group is 0.00

For Silny 2006, the average p-value of control group is 0.00 of treatme
nt group is 0.06
```

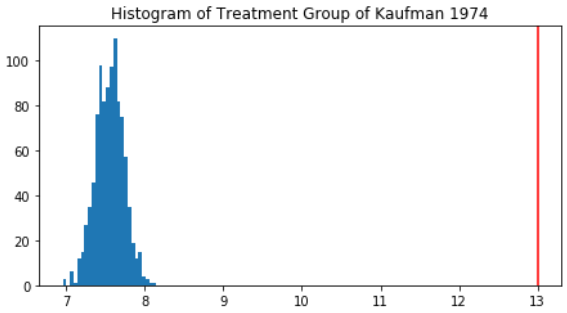

Histogram of Control Group of Di Rienzo 2014

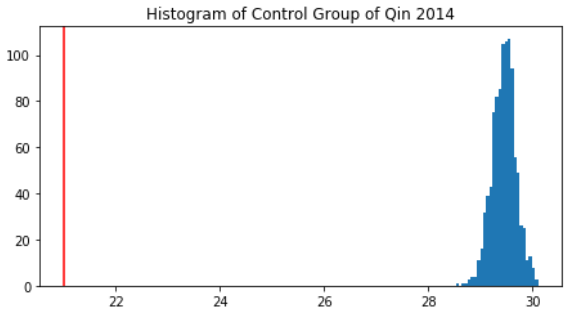

Histogram of Treatment Group of Di Rienzo 2014

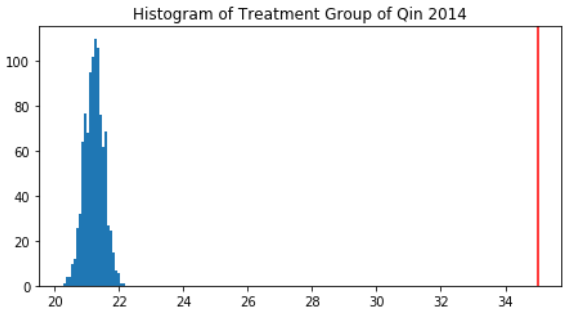

Histogram of Control Group of Galli 1994

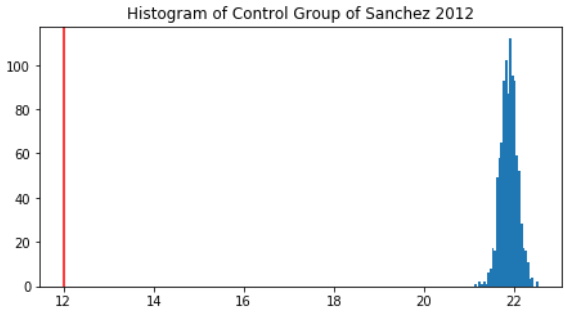

Histogram of Treatment Group of Galli 1994

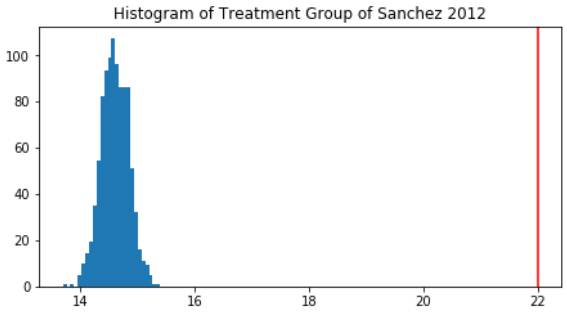

Histogram of Control Group of Kaufman 1974

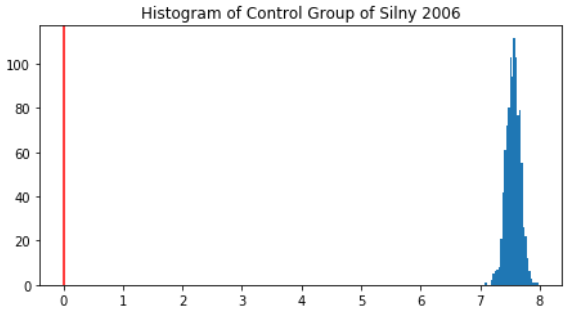

Histogram of Treatment Group of Kaufman 1974

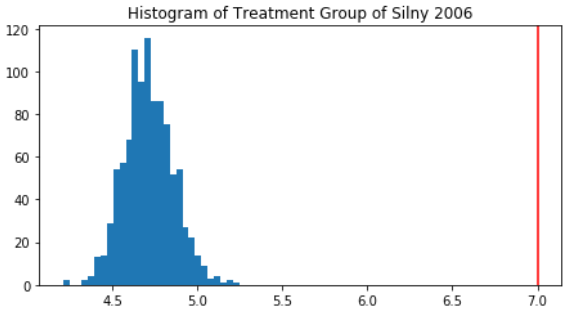

Histogram of Control Group of Qin 2014


Histogram of Treatment Group of Qin 2014


Histogram of Control Group of Sanchez 2012


Histogram of Treatment Group of Sanchez 2012


Histogram of Control Group of Silny 2006


Histogram of Treatment Group of Silny 2006