

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
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```
ds=pd.read_csv("UCB.csv")
print(ds.shape)
print(ds.head(5))
```

```
(20, 11)
```

	ad0	ad1	ad2	ad3	ad4	ad5	ad6	ad7	ad8	ad9	ad10
0	0	1	0	1	0	0	0	1	0	0	1
1	0	0	0	1	0	0	0	0	0	0	0
2	0	0	0	0	0	1	0	0	0	0	0
3	1	0	0	0	0	0	0	0	0	1	0
4	0	0	0	0	0	0	1	0	1	1	0

```
import math
observations=20
no_of_ads=10
ads_selected=[]
number_of_selections_of_each_ads=[0]*no_of_ads
sums_of_rewards_of_each_ads=[0]*no_of_ads
total_reward=0
for n in range(0,observations):
    ad=0
    max_upper_bound=0
    for i in range(0,no_of_ads):
        if(number_of_selections_of_each_ads[i]>0):
            average_reward=sums_of_rewards_of_each_ads[i]/number_of_selections_of_each_ads[i]
            delta_i=math.sqrt(3/2*(math.log(n+1)/number_of_selections_of_each_ads[i]))
            upper_bound=average_reward+delta_i
        else:
            upper_bound=1e400
    if upper_bound>max_upper_bound:
        max_upper_bound=upper_bound
        ad=i
    ads_selected.append(ad)
    number_of_selections_of_each_ads[ad]=number_of_selections_of_each_ads[ad]+1
    reward=ds.values[n,ad]
    sums_of_rewards_of_each_ads[ad]=sums_of_rewards_of_each_ads[ad]+reward
    total_reward=total_reward+reward
print("Rewards by ads=",sums_of_rewards_of_each_ads)
print("Total Rewards by UCB=",total_reward)
print("Ads selected at each round=",ads_selected)
```

```
Rewards by ads= [np.int64(5), np.int64(4), np.int64(2), np.int64(3), np.int64(6), np.int64(1), np.int64(3), np.int64(5)
Total Rewards by UCB= 38
Ads selected at each round= [0, 0, 1, 0, 1, 2, 0, 1, 2, 3, 0, 2, 3, 4, 0, 1, 2, 3, 4, 5, 0, 2, 4, 5, 6, 0, 2, 3, 4, 6,
```

```
plt.hist(ads_selected,color='violet')
plt.title("Histogram of ads selected")
plt.xlabel("Ads")
plt.ylabel("Number of times each ad was selected")
plt.show()
```

