In [5]:

```python
import matplotlib as plt
import seaborn as sns
import pandas as pd
import numpy as np
import json as js
```

In [6]:

```python
pwd
```

Out[6]: '/Users/mingyuanma/Desktop'

In [7]:

```python
before = pd.read_csv("combined1.csv")
before
```

Out[7]:

	ResponseId	round	tick	orderId	taskId	taskTicks	workerId	workerTicks	label
0	R_0uOsLe6BeLnUee5	1	1	1	1	2	0	0	3
1	R_0uOsLe6BeLnUee5	1	1	2	1	2	1	0	3
2	R_0uOsLe6BeLnUee5	1	1	0	0	0	0	0	3
3	R_0uOsLe6BeLnUee5	1	2	3	1	2	2	0	3
4	R_0uOsLe6BeLnUee5	1	2	0	0	0	0	0	3
...	...	...	...	...	...	...	...	...	...
100561	R_zTlbYwl8ijcujhn	6	33	0	0	0	0	0	1
100562	R_zTlbYwl8ijcujhn	6	33	0	0	0	0	0	1
100563	R_zTlbYwl8ijcujhn	6	34	4	3	2	1	0	1
100564	R_zTlbYwl8ijcujhn	6	34	0	0	0	0	0	1
100565	R_zTlbYwl8ijcujhn	6	34	0	0	0	0	0	1

100566 rows × 9 columns

In [ ]:

In [8]:

```python
after = pd.read_csv("combined2.csv")
after
```

Out[8]:

	ResponseId	round	tick	orderId	taskId	taskTicks	workerId	workerTicks	label
0	R_0HBxBV8U696D9QJ	1	1	1	1	2	0	0	2
1	R_0HBxBV8U696D9QJ	1	1	2	1	2	1	0	2
2	R_0HBxBV8U696D9QJ	1	1	3	1	2	2	0	2
3	R_0HBxBV8U696D9QJ	1	2	0	0	0	0	0	2
4	R_0HBxBV8U696D9QJ	1	2	0	0	0	0	0	2
...	...	...	...	...	...	...	...	...	...
141757	R_zZQIbE0LFD13yRX	6	37	0	0	0	0	0	3
141758	R_zZQIbE0LFD13yRX	6	37	0	0	0	0	0	3
141759	R_zZQIbE0LFD13yRX	6	38	4	3	2	1	0	3
141760	R_zZQIbE0LFD13yRX	6	38	0	0	0	0	0	3
141761	R_zZQIbE0LFD13yRX	6	38	0	0	0	0	0	3

141762 rows × 9 columns

In [ ]:

chi-square testing

In [178…

```python
from scipy.stats import chi2_contingency
from collections import Counter

def chisquare(array1, array2, count=True):
    if not count:
        data = [array1, array2]
        stat, p, dof, expected = chi2_contingency(data)

    else:
        c1, c2 = Counter(array1), Counter(array2)
        before_dis, after_dis = [], []
        for i in set(c1).union(set(c2)):
            before_dis.append(c1[i])
            after_dis.append(c2[i])
        print(before_dis)
        print(after_dis)
        data = [before_dis, after_dis]
        stat, p, dof, expected = chi2_contingency(data)

    alpha = 0.05
    print("p value is " + str(p))
    if p <= alpha:
        print('difference between the two distributions (reject H0)')
    else:
        print('no difference between the two distributions (H0 holds true)')
```

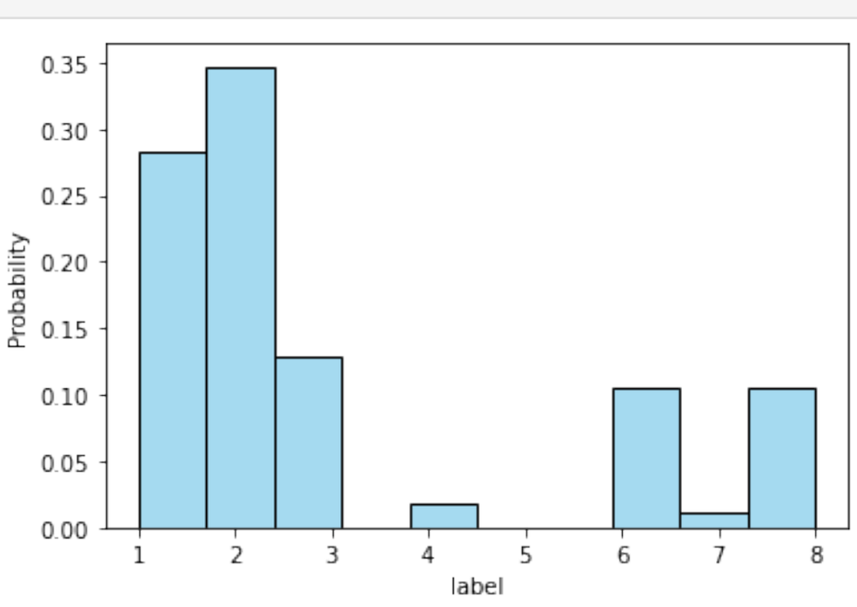
Distribution of label before and after

In [18]:

```python
d1 = before.groupby("ResponseId", as_index=False).agg(lambda x:x.iloc[0])
d2 = after.groupby("ResponseId", as_index=False).agg(lambda x:x.iloc[0])
```

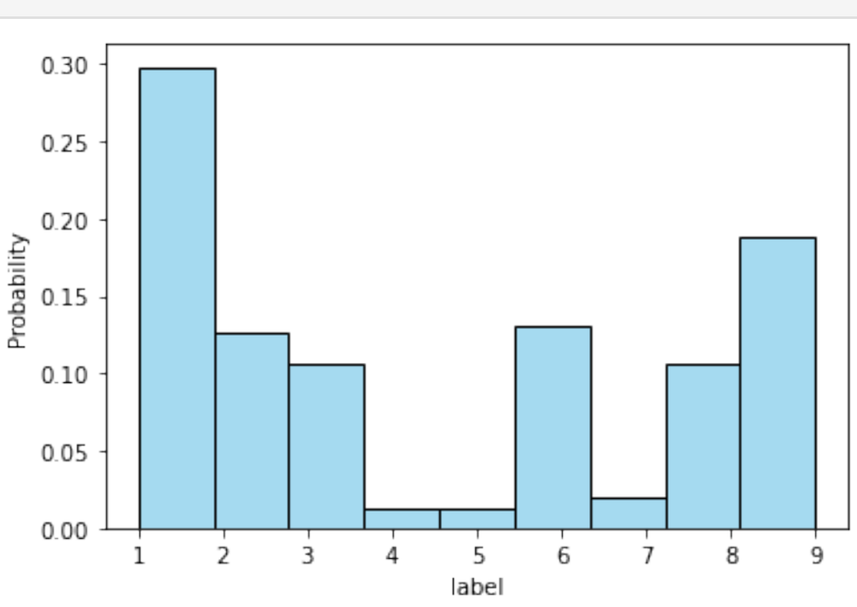
In [64]:

```python
sns.histplot(data=d1, x="label", stat="probability", color="skyblue");
```



In [65]:

```python
sns.histplot(data=d2, x="label", stat="probability", color="skyblue");
```



Chi-Square Testing

In [179…

```python
chisquare(d1["label"], d2["label"])
```

```
[48, 59, 22, 3, 0, 18, 2, 18, 0]
[73, 31, 26, 3, 3, 32, 5, 26, 46]
p value is 1.0415585870358675e-09
difference between the two distributions (reject H0)
```

Analysis of Compliance

In [268…

```python
def compliance(df):
    ids = []
    rounds = []
    server = []
    label = []
    for player in set(np.array(df["ResponseId"])):
        for i in np.arange(1,7):
            tem = df[(df["ResponseId"] == player) & (df["round"] == i)]
            if len(tem) != 0: # no response there
                ids.append(player)
                rounds.append(i)
                l = df[(df["ResponseId"] == player)]["label"].iloc[0]
                label.append(l)
                if i <= 2:
                    num = sum((tem["workerId"] == 2) & (tem["taskId"] == 1))
                else:
                    num = sum((tem["workerId"] == 1) & (tem["taskId"] == 1))
                server.append(num)
            else:
                print(player, i)
    d = {
        "ResponseId": ids,
        "round": rounds,
        "numServerCook": server,
        "label": label
    }
    return pd.DataFrame(d)
```

In [269…

```python
before_compliance = compliance(before)
```

In [271…

```python
after_compliance = compliance(after)
```

In [272…

```python
before_compliance
```

Out[272…

	ResponseId	round	numServerCook	label
0	R_2ykqjCa36BsYwZF	1	1	2
1	R_2ykqjCa36BsYwZF	2	0	2
2	R_2ykqjCa36BsYwZF	3	2	2
3	R_2ykqjCa36BsYwZF	4	2	2
4	R_2ykqjCa36BsYwZF	5	3	2
...	...	...	...	...
1015	R_3HXrkaEHfDcmalh	2	0	1
1016	R_3HXrkaEHfDcmalh	3	2	1
1017	R_3HXrkaEHfDcmalh	4	3	1
1018	R_3HXrkaEHfDcmalh	5	3	1
1019	R_3HXrkaEHfDcmalh	6	2	1

1020 rows × 4 columns

In [273…

```python
after_compliance
```

Out[273…

	ResponseId	round	numServerCook	label
0	R_31N6XgNWAmSoPju	1	2	3
1	R_31N6XgNWAmSoPju	2	2	3
2	R_31N6XgNWAmSoPju	3	2	3
3	R_31N6XgNWAmSoPju	4	2	3
4	R_31N6XgNWAmSoPju	5	2	3
...	...	...	...	...
1465	R_eX50rUyYLBelOkN	2	1	1
1466	R_eX50rUyYLBelOkN	3	2	1
1467	R_eX50rUyYLBelOkN	4	3	1
1468	R_eX50rUyYLBelOkN	5	3	1
1469	R_eX50rUyYLBelOkN	6	2	1

1470 rows × 4 columns

In [ ]:

group by rounds

In [275…

```python
round_before = before_compliance.groupby("round").agg(np.average).loc[:,["numServerCook"]]
round_before
```

Out[275…

round	numServerCook
1	1.141176
2	0.994118
3	2.552941
4	2.670588
5	2.617647
6	2.500000

In [276…

```python
round_after = after_compliance.groupby("round").agg(np.average).loc[:,["numServerCook"]]
round_after
```

Out[276…

round	numServerCook
1	1.204082
2	1.061224
3	2.408163
4	2.232653
5	2.163265
6	2.044898

In [278…

```python
a = np.array(round_before["numServerCook"])
```

In [279…

```python
b = np.array(round_after["numServerCook"])
```

chi-square testing

In [280…

```python
chisquare(a, b, count=False)
```

```
p value is 0.999958667113752
no difference between the two distributions (H0 holds true)
```

In [ ]:

group by tip

In [281…

```python
tip_before = before_compliance.groupby("label", as_index=False).agg(np.average).loc[:,["label","numServerCook"]]
tip_before
```

Out[281…

	label	numServerCook
0	1	2.142361
1	2	2.033898
2	3	2.007576
3	4	1.944444
4	6	2.157407
5	7	2.416667
6	8	2.055556

In [282…

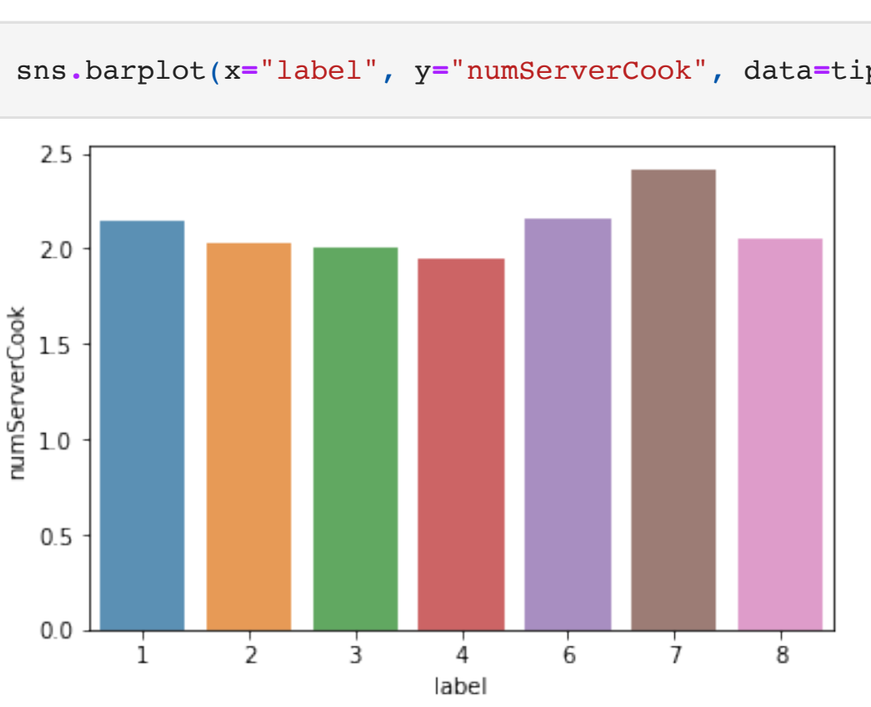
```python
tip_after = after_compliance.groupby("label", as_index=False).agg(np.average).loc[:,["label","numServerCook"]]
tip_after
```

Out[282…

	label	numServerCook
0	1	1.805936
1	2	1.795699
2	3	2.102564
3	4	1.500000
4	5	1.555556
5	6	1.833333
6	7	2.333333
7	8	2.108974
8	9	1.681159

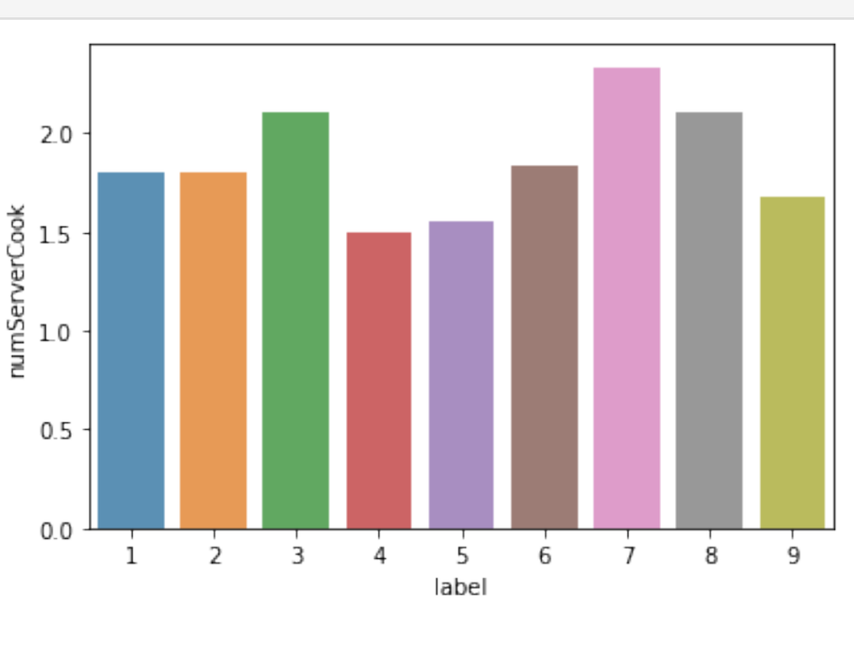
In [284…

```python
sns.barplot(x="label", y="numServerCook", data=tip_before, alpha=0.8);
```



In [285…

```python
sns.barplot(x="label", y="numServerCook", data=tip_after, alpha=0.8);
```



chi-square testing

In [286…

```python
np.array(tip_before["numServerCook"])
```

Out[286…

```
array([2.14236111, 2.03389831, 2.00757576, 1.94444444, 2.15740741,
       2.41666667, 2.05555556])
```

In [287…

```python
tb = np.array([2.14236111, 2.03389831, 2.00757576, 1.94444444, 0, 2.15740741, 2.41666667, 2.05555556, 0])
chisquare(np.array(tb),
         np.array(tip_after["numServerCook"]),count=False)
```

```
p value is 0.9170727120567413
no difference between the two distributions (H0 holds true)
```

In [ ]:

Testing Aversion Distribution

In [322…

```python
ave_before = before_compliance[(before_compliance["numServerCook"] >= 3)
                              | (before_compliance["numServerCook"] == 0)].groupby(
                               "label").count().loc[:,["round"]]
ave_before = ave_before.rename(columns = {"round":"numAversion"})
```

In [323…

```python
ave_after = after_compliance[(after_compliance["numServerCook"] >= 3)
                            | (after_compliance["numServerCook"] == 0)].groupby(
                             "label").count().loc[:,["round"]]
ave_after = ave_after.rename(columns = {"round":"numAversion"})
```

In [324…

```python
def counting(df):
    count = []
    for i in np.arange(1,10):
        cou = len(df[df["label"] == i])
        count.append(cou)
    return count
```

In [325…

```python
counting(before_compliance), counting(after_compliance)
[_ for _ in counting(before_compliance) if _]
```

Out[325… [288, 354, 132, 18, 108, 12, 108]

In [326…

```python
ave_before['total_num_label'] = [_ for _ in counting(before_compliance) if _]
ave_before["proportion_aversion"] = ave_before["numAversion"] / ave_before['total_num_label']
ave_before["proportion_label"] = ave_before['total_num_label'] / before_compliance.shape[0]
ave_before
```

Out[326…

label	numAversion	total_num_label	proportion_aversion	proportion_label
1	84	288	0.291667	0.282353
2	123	354	0.347458	0.347059
3	53	132	0.401515	0.129412
4	6	18	0.333333	0.017647
6	33	108	0.305556	0.105882
7	10	12	0.833333	0.011765
8	42	108	0.388889	0.105882

In [327…

```python
ave_after['total_num_label'] = counting(after_compliance)
ave_after["proportion_aversion"] = ave_after["numAversion"] / ave_after['total_num_label']
ave_after["proportion_label"] = ave_after['total_num_label'] / after_compliance.shape[0]
ave_after
```

Out[327…

label	numAversion	total_num_label	proportion_aversion	proportion_label
1	103	438	0.235160	0.297959
2	52	186	0.279570	0.126531
3	53	156	0.339744	0.106122
4	2	18	0.111111	0.012245
5	5	18	0.277778	0.012245
6	33	192	0.171875	0.130612
7	19	30	0.633333	0.020408
8	50	156	0.320513	0.106122
9	45	276	0.163043	0.187755

In [ ]:

Testing Compliance Distribution

In [337…

```python
com_before = before_compliance[before_compliance["numServerCook"] ==2].groupby(
                               "label").count().loc[:,["round"]]
com_before = com_before.rename(columns = {"round":"numCompliance"})
```

In [330…

```python
com_after = after_compliance[after_compliance["numServerCook"] ==2].groupby(
                               "label").count().loc[:,["round"]]
com_after = com_after.rename(columns = {"round":"numCompliance"})
com_after
```

Out[330…

label	numCompliance
1	216
2	82
3	66
4	8
5	9
6	109
7	4
8	61
9	118

In [335…

```python
com_before['total_num_label'] = [288, 354, 132, 18, 108, 108]
com_before["proportion_compliance"] = com_before["numCompliance"] / com_before['total_num_label']
com_before["proportion_label"] = com_before['total_num_label'] / before_compliance.shape[0]
com_before
```

Out[335…

label	numCompliance	total_num_label	proportion_compliance	proportion_label
1	150	288	0.520833	0.282353
2	164	354	0.463277	0.347059
3	58	132	0.439394	0.129412
4	8	18	0.444444	0.017647
6	48	108	0.444444	0.105882
8	32	108	0.296296	0.105882

In [338…

```python
com_after['total_num_label'] = counting(after_compliance)
com_after["proportion_compliance"] = com_after["numCompliance"] / com_after['total_num_label']
com_after["proportion_label"] = com_after['total_num_label'] / after_compliance.shape[0]
com_after
```

Out[338…

label	numCompliance	total_num_label	proportion_compliance	proportion_label
1	216	438	0.493151	0.297959
2	82	186	0.440860	0.126531
3	66	156	0.423077	0.106122
4	8	18	0.444444	0.012245
5	9	18	0.500000	0.012245
6	109	192	0.567708	0.130612
7	4	30	0.133333	0.020408
8	61	156	0.391026	0.106122
9	118	276	0.427536	0.187755

In [ ]:

In [ ]:

In [ ]: