MuscleHub A/B Test

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Introduction the test background

MuscleHub A/B test introduction and background

Currently, when a visitor to MuscleHub is considering buying a membership, he or she follows the following steps:

- Take a fitness test with a personal trainer
- Fill out an application for the gym
- Send in their payment for their first month's membership

Janet, the manager of MuscleHub, thinks that the fitness test intimidates some prospective members, so she has set up an A/B test.

Visitors will randomly be assigned to one of two groups:

- Group A will still be asked to take a fitness test with a personal trainer
- Group B will skip the fitness test and proceed directly to the application

Janet's hypothesis is that visitors assigned to Group B will be more likely to eventually purchase a membership to MuscleHub.

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Procedure of the A/B test

Procedure of the A/B test

Step 1: Get started with SQL

The MuscleHub data is kept in a SQL database. Download the data from the database to a csv file and then load it into a Jupyter Notebook using Pandas.
Use Codecademy library and type SQL queries directly into this notebook. Pass each SQL query as an argument to a function called `sql_query`. Each query will return a Pandas DataFrame.

Step 2: Get the dataset

MuscleHub has a SQLite database, which contains several tables that will be helpful in this investigation:
- `visits` contains information about potential gym customers who have visited MuscleHub
- `fitness_tests` contains information about potential customers in "Group A", who were given a fitness test
- `applications` contains information about any potential customers (both "Group A" and "Group B") who filled out an application. Not everyone in `visits` will have filled out an application.
-    `purchases` contains information about customers who purchased a membership to MuscleHub.
Download the data frame contains all the tables above.
Pull data where `visit_date` is on or after `7-1-17`.
Combine the four tables we care about and save the query as the dataset.

Procedure of the A/B test

Step 3: Investigate the A and B groups

Group the visitors by the content of `fitness_tests` .
The code is as below:

```
df['ab_test_group'] = df.fitness_test_date.apply(lambda x:
                              'A' if pd.notnull(x) else 'B')
```

Count how many members are in each group.
The code is as below:

```
ab_counts = df.groupby('ab_test_group').first_name.count().reset_index()
ab_counts
```

Procedure of the A/B test

Step 4: Investigate who picks up an application in each group.

The sign-up process for MuscleHub has several steps:
1. Take a fitness test with a personal trainer (only Group A)
2. Fill out an application for the gym
3. Send in their payment for their first month's membership

Examine how many people make it to Step 2, filling out an application by using `groupby`.
Count how many people from Group A and Group B either do or don't pick up an application.

Calculate the percent of people in each group who complete an application. It looks like more people from Group B turned in an application.
Choose Chi-square test to verify if this difference is statistically significant.
The code is as below:

```
from scipy.stats import chi2_contingency

contingency = [[250, 2254], [325, 2175]]
chi2_contingency(contingency)
```

Procedure of the A/B test

Step 5: Investigate those who picked up an application, how many purchased a membership?

Count how many people who picked an application from Group A and Group B either do or don't purchase a membership.

Calculate the percent of people in each group who purchased an a membership. It looks like more people from Group A turned in a purchase.

Choose Chi-square test to verify if this difference is statistically significant.

Step 6: Investigate the most important point that those who just visited the muscle hub, how many purchased a membership?

Count how many people who visited the hub from Group A and Group B either do or don't purchase a membership.

Calculate the percent of people in each group who purchased an a membership. It looks like more people from Group B who didn't take the fitness test turned in a purchase.

Choose Chi-square test to verify if this difference is statistically significant.

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Summary of the dataset and information

Summary of the dataset

The dataset contains the data information as below:

	first_name	last_name	visit_date	fitness_test_date	application_date	purchase_date
0	Kim	Walter	7-1-17	2017-07-03	None	None
1	Tom	Webster	7-1-17	2017-07-02	None	None
2	Edward	Bowen	7-1-17	None	2017-07-04	2017-07-04
3	Marcus	Bauer	7-1-17	2017-07-01	2017-07-03	2017-07-05

The dataset contains the information of 5004 victors and the A/B group is counted by ab_counts.

	ab_test_group	first_name
0	A	2504
1	B	2500

We can see that the A group has 2504 visitors and the B group has 2500 visitors and the pie graph is as right.
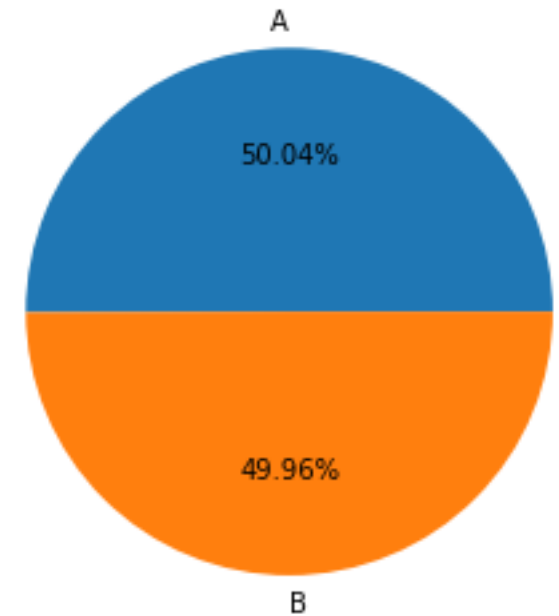
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Results of the hypothesis tests

Reasons for using chi-square hypothesis test

In this project, I use Chi-square test for the reasons below:

- The basic idea of chi-square test is to infer whether the overall distribution is significantly different from the expected distribution according to the sample data, or whether the two classification variables are correlated or independent.
- The chi-square test is often used for feature selection.
- The chi-square test is suitable for larger samples which is better than T-test in this project.

We have the hypothesis as below:

H0:There is no significant difference between group A and B

H1:There is significant difference between group A and B

First hypothesis test on who pick up the application

The first test is about who picks up an application in each group.

The result of members who picks up the application is as following.

is_application	ab_test_group	Application	No Application	Total	Percent with application
0	A	250	2254	2504	0.09984
1	B	325	2175	2500	0.13000

We can see that there are more visitors who didn't take the fitness tests picked up the application.
The possible reason is that the fitness test scared some visitors or the sampling error.

The chi-square test result is as below:

```
Out[5]:
(10.893961295282612,
 0.0009647827600722304,
 1,
 array([[ 287.72981615, 2216.27018385],
        [ 287.27018385, 2212.72981615]]))
```

We can see that the p-value is 0.000964 that the result is significant.

Second hypothesis test on who paid the membership after application

The second test is to investigate those who picked up an application, how many purchased a membership?

The result of members who purchased the membership is as following.

is_member	ab_test_group	Member	Not Member	Total	Percent Purchase
0	A	200	50	250	0.800000
1	B	250	75	325	0.769231

We can see that there are more visitors who took the fitness tests paid the membership after the application.
The possible reason is that the fitness test attracted some visitors or just the sampling error.

The chi-square test result is as below:

```
Out[7]:
(0.615869230769231,
 0.43258646051083327,
 1,
 array([[195.65217391,  54.34782609],
        [254.34782609,  70.65217391]]))
```

We can see that the p-value is 0.432 that the result is not significant.

Third hypothesis test on who paid the membership in visitors

The third test is to investigate those visitors, how many purchased a membership?

The result of members who purchased the membership in visitors is as following.

is_member	ab_test_group	Member	Not Member	Total	Percent Purchase
0	A	200	2304	2504	0.079872
1	B	250	2250	2500	0.100000

We can see that there are more visitors who didn't take the fitness tests paid the membership.

The chi-square test result is as below:

```
Out[9]:
(5.949182292591156,
 0.01472411464578203,
 1,
 array([[ 225.17985612,  2278.82014388],
        [ 224.82014388,  2275.17985612]]))
```

We can see that the p-value is 0.0147 that the difference result is significant.

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Summary of the
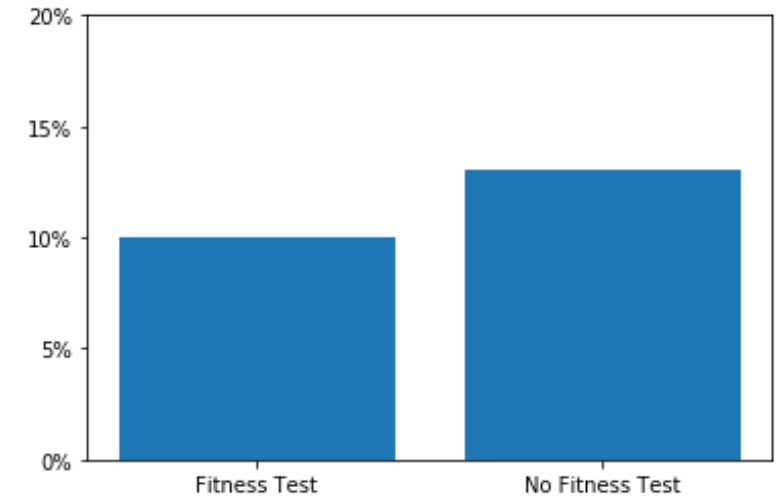qualitive data

Summary of the qualitive data

The result show that more people from Group B turned in an application.
The percentage result is as below:
Group A:10%
Group B:13%

The chi-square test p-value result is 0.0009 which indicate that the difference is significant.
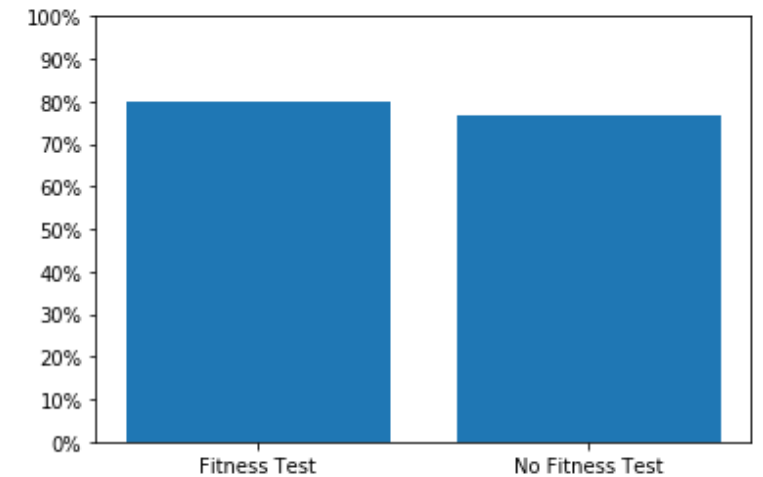

The result show that more people from Group A paid the membership after the application.
The percentage result is as below:
Group A:8%
Group B:7.7%

The chi-square test p-value result is 0.43 which indicate that the difference is not significant.
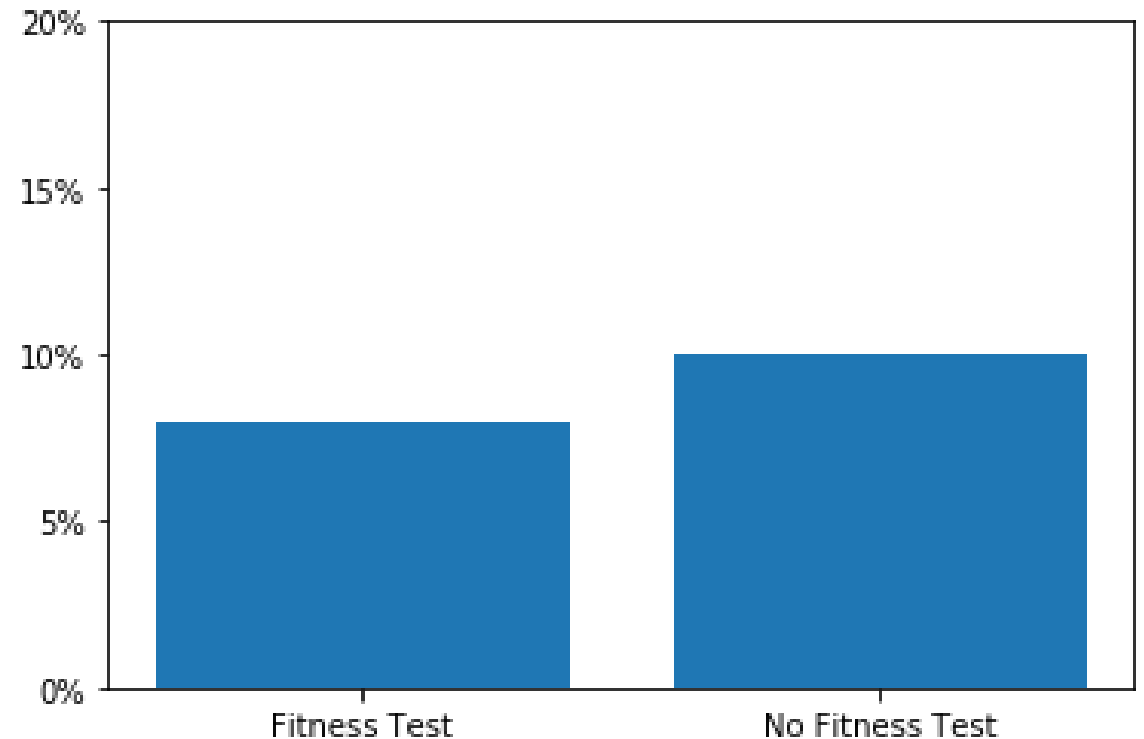
Summary of the qualitive data

The result show that more visitors from Group B paid the membership.
The percentage result is as below:
Group A:8%
Group B:10%

The chi-square test p-value result is 0.014 which indicate that the difference is significant.

Prove that visitors assigned to Group B will be more likely to eventually purchase a membership to MuscleHub.

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PART

Recommendation

Recommendation for MuscleHub

The A/B test results confirmed the hypothesis that the fitness test intimidates some prospective members.

Recommendation is as below:

1.To ensure the correctness of the A/B test, it is better to collect more data and make the sample bigger to reduce the failure possibility of A/B test.

2.After the confirmation, the visitors shall skip the fitness test and process directly to the application.