Data Bias: Fairness Gerrymandering

In this exercise you will slip into the role of data scientists that are requested as data experts for a judicial dispute. The scenario in dispute is as follows:

A woman of color applied for a job at the company *MajorEngine*, but got rejected. She suspects that she got turned down for racist and sexist reasons, *i.e.* because she is a woman of color. *MajorEngine* refutes this claim and provides employment records in court in order to disprove the claims.

In [ ]:
```
import pandas as pd
import matplotlib.pyplot as plt

# load the data from the file 'hiring_records_MajorEngine.csv' and inspect the first rows with the pandas function 'head'
# TODO: Your code goes here

df = pd.read_csv('hiring_records_MajorEngine.csv')

df.head()
```

Out[ ]:

	gender	race
0	male	white
1	female	white
2	female	white
3	male	white
4	male	hispanic

Task 1

Slip into the role of a data scientist hired by *MajorEngine* in order to show that based on the employment records

(a) the company has no racist hiring policy, and

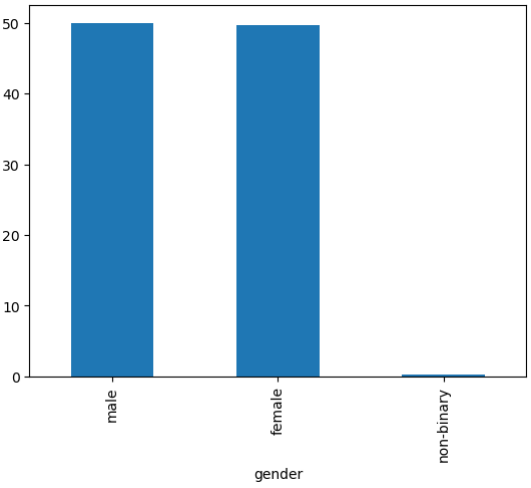
(b) has no strongly sexist hiring policy. Note that according to the 2020 U.S. census, the perfect, expected percentage of white employees would be 61.6%.

Use bar charts to convey your findings to a lay person and write a comment that explains your figure in favor of *MajorEngine*.

Hint: While exploring the dataset, look at the ratio of white employees vs. non-white employees, and the ratio of male employees vs. non-male employees. It can also be useful to create a plot of the ideal distribution as comparison.

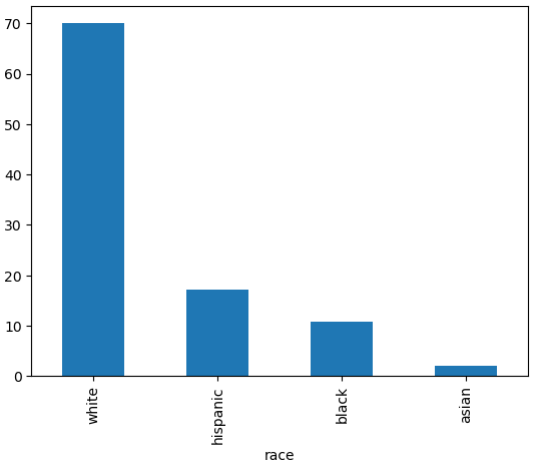
In [ ]:
```
# Part (a): show that MajorEngine has no strongly racist hiring policy

# TODO: Your code goes here

import pandas as pd
import matplotlib.pyplot as plt

df = pd.read_csv('hiring_records_MajorEngine.csv')

gender_count = df['gender'].value_counts(normalize=True)*100

gender_count.plot(kind='bar')
```

Out[ ]:
```
<Axes: xlabel='gender'>
```



In [ ]:
```
# Part (b): Show that MajorEngine has no sexist hiring policy

# TODO: Your code goes here

import pandas as pd
import matplotlib.pyplot as plt

df = pd.read_csv('hiring_records_MajorEngine.csv')

race_count = df['race'].value_counts(normalize=True)*100

race_count.plot(kind='bar')
```

Out[ ]:
```
<Axes: xlabel='race'>
```



Task 2

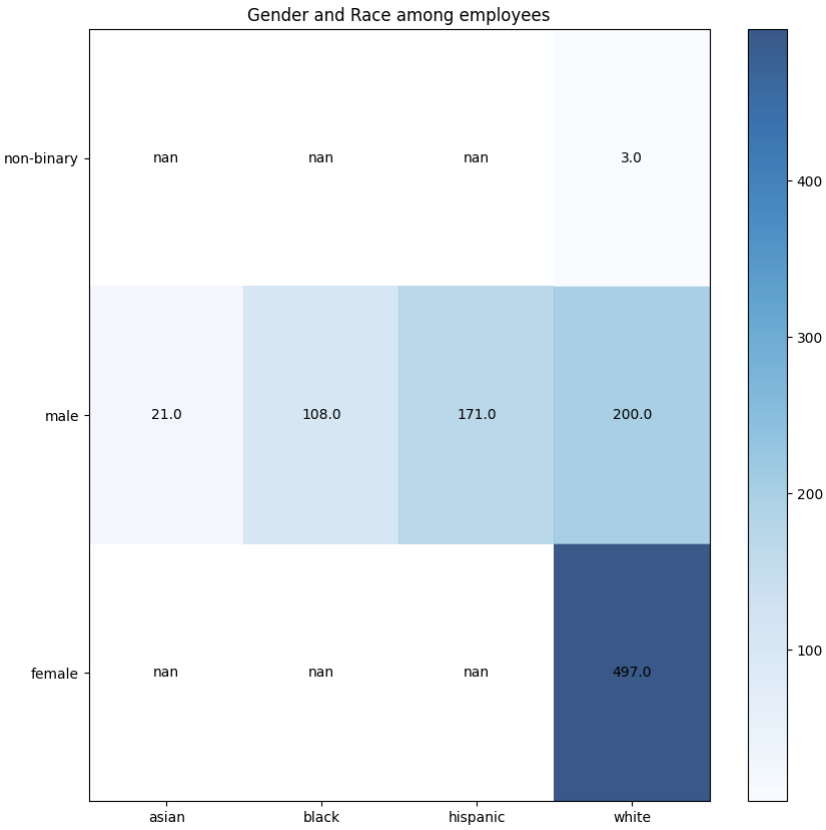
Slip into the role of a data scientist that works pro bono in order to demonstrate that *MajorEngine* has exhibited a bias in the past and thus is likely to have treated the woman of color unfairly.

Use a confusion matrix to convey your findings to a lay person.

Hint: While superficially, the argumentation form task 1 may seem sound, you have the sneaking suspicion that you should look at the two attributes 'race' and 'gender' in combination instead of separately.

Second hint: You may create a makeshift confusion matrix by creating another pandas dataframe of the four intersectional values and renaming columns and index.

In [ ]:
```python
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np

df = pd.read_csv('hiring_records_MajorEngine.csv')

count_df = df.groupby(['gender', 'race']).size().reset_index(name='count')

pivot_df = count_df.pivot(index='gender', columns='race', values='count')

plt.figure(figsize=(10, 10))
plt.title('Gender and Race among employees')
heatmap = plt.pcolor(pivot_df, cmap=plt.cm.Blues, alpha=0.8)

plt.xticks(np.arange(0.5, len(pivot_df.columns), 1), pivot_df.columns)
plt.yticks(np.arange(0.5, len(pivot_df.index), 1), pivot_df.index)

for race_idx, race in enumerate(pivot_df.columns):
    for gender_idx, gender in enumerate(pivot_df.index):
        count = pivot_df.loc[gender, race]
        plt.text(race_idx + 0.5, gender_idx + 0.5, count, ha='center', va='center', color='black')

plt.colorbar(heatmap)
plt.show()
```



Side note: The court case and its arguments are based on a true story. The provided data is obviously made up in order to paint a clearer picture for pedagogic reasons.