Data Warehouse Assignment

Lab 4

Gyanendra Kr Shukla
191112040
CSE-1

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

```
titanic_df = pd.read_excel('titanic.xls')
print("Describing the dataframe:")
titanic_df.describe()
```

```
Describing the dataframe:
```

```
            pclass     survived          age        sibsp        parch  \
count  1309.000000  1309.000000  1046.000000  1309.000000  1309.000000
mean      2.294882     0.381971    29.881135     0.498854     0.385027
std       0.837836     0.486055    14.413500     1.041658     0.865560
min       1.000000     0.000000     0.166700     0.000000     0.000000
25%       2.000000     0.000000    21.000000     0.000000     0.000000
50%       3.000000     0.000000    28.000000     0.000000     0.000000
75%       3.000000     1.000000    39.000000     1.000000     0.000000
max       3.000000     1.000000    80.000000     8.000000     9.000000

              fare
count  1308.000000
mean     33.295479
std      51.758668
min       0.000000
25%       7.895800
50%      14.454200
75%      31.275000
max     512.329200
```

```
print("First 5 rows of the dataframe:")
titanic_df.head()
```

```
First 5 rows of the dataframe:
```

```
   pclass  survived                                             name     sex  \
0       1         1                    Allen, Miss. Elisabeth Walton  female
1       1         1                   Allison, Master. Hudson Trevor    male
2       1         0                     Allison, Miss. Helen Loraine  female
3       1         0             Allison, Mr. Hudson Joshua Creighton    male
4       1         0  Allison, Mrs. Hudson J C (Bessie Waldo Daniels)  female
```

```
       age  sibsp  parch  ticket      fare embarked
0  29.0000      0      0   24160  211.3375        S
1   0.9167      1      2  113781  151.5500        S
2   2.0000      1      2  113781  151.5500        S
3  30.0000      1      2  113781  151.5500        S
4  25.0000      1      2  113781  151.5500        S
```

Q1. WAP to compute following on the titanic dataset

1. Counting missing values in each column
2. Removing rows/attributes with missing values and calculating the ratio with respect to original data
3. Replacing missing values of the age attribute with
   (a) Mean
   (b) Median

```
# Counting missing values in each column
nas = {}
for series in titanic_df:
    na = 0
    for value in titanic_df[series]:
        # print(value, end=', ')
        if pd.isnull(value):
            na += 1
    nas[series] = na
null_vals = pd.Series(nas, name="No. of null values")


# Removing rows with missing values
titanic_row_null_removed = titanic_df.copy()
null = []
for row in titanic_df.itertuples():
    for val in list(row)[1:]:
        if pd.isnull(val):
            null.append(row[0])
            break

for row in null:
    titanic_row_null_removed.drop(row, inplace=True)
print(f"Ratio of original with null removed dataframe: {titanic_row_null_removed.shape[0]/ti
```

```
Ratio of original with null removed dataframe: 0.7967914438502673
```

```
# removing columns with missing values
titanic_col_null_removed = titanic_df.copy()
null = []
for col in titanic_df.columns:
```

```
    for val in titanic_df[col].tolist():
        if pd.isnull(val):
            null.append(col)
            break
for col in null:
    titanic_col_null_removed.drop(col, axis=1, inplace=True)
print(f"Ratio of original with null removed dataframe: {titanic_col_null_removed.shape[1]/ti
```

```
Ratio of original with null removed dataframe: 0.7
```

```
# replacing missing values of attribute with mean
titanic_df['meanfilled-age'] = titanic_df['age'].fillna(titanic_df['age'].mean())

titanic_df.describe()
```

```
            pclass     survived          age        sibsp        parch  \
count  1309.000000  1309.000000  1046.000000  1309.000000  1309.000000
mean      2.294882     0.381971    29.881135     0.498854     0.385027
std       0.837836     0.486055    14.413500     1.041658     0.865560
min       1.000000     0.000000     0.166700     0.000000     0.000000
25%       2.000000     0.000000    21.000000     0.000000     0.000000
50%       3.000000     0.000000    28.000000     0.000000     0.000000
75%       3.000000     1.000000    39.000000     1.000000     0.000000
max       3.000000     1.000000    80.000000     8.000000     9.000000

              fare  meanfilled-age
count  1308.000000     1309.000000
mean     33.295479       29.881135
std      51.758668       12.883199
min       0.000000        0.166700
25%       7.895800       22.000000
50%      14.454200       29.881135
75%      31.275000       35.000000
max     512.329200       80.000000
```

```
# replacing missing values of attribute with median
titanic_df['medianfilled-age'] = titanic_df['age'].fillna(titanic_df['age'].median())

titanic_df.describe()
```

```
            pclass     survived          age        sibsp        parch  \
count  1309.000000  1309.000000  1046.000000  1309.000000  1309.000000
mean      2.294882     0.381971    29.881135     0.498854     0.385027
std       0.837836     0.486055    14.413500     1.041658     0.865560
min       1.000000     0.000000     0.166700     0.000000     0.000000
25%       2.000000     0.000000    21.000000     0.000000     0.000000
50%       3.000000     0.000000    28.000000     0.000000     0.000000
75%       3.000000     1.000000    39.000000     1.000000     0.000000
```

```
max       3.000000     1.000000    80.000000     8.000000     9.000000
```

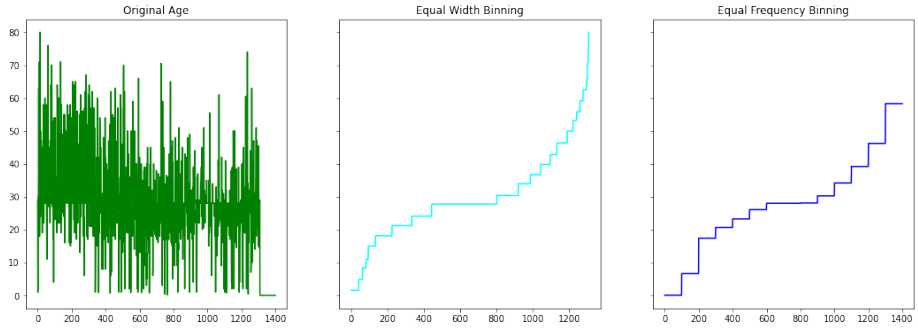
```
              fare  meanfilled-age  medianfilled-age
count  1308.000000     1309.000000       1309.000000
mean     33.295479       29.881135         29.503183
std      51.758668       12.883199         12.905246
min       0.000000        0.166700          0.166700
25%       7.895800       22.000000         22.000000
50%      14.454200       29.881135         28.000000
75%      31.275000       35.000000         35.000000
max     512.329200       80.000000         80.000000
```

Q2. WAP to perform transformation of data on age attribute of Titanic dataset using Binning

1. With equal width bins using K=25, using mean (you may fill zero value to balance last bin)
2. With equal frequency bins of size 100 using mean (you may fill zero value to balance last bin)

```
def binning_equal_width(ageser, k):
    w = (max(ageser) - min(ageser))/k
    bins = [min(ageser) + i*w for i in range(k+1)]
    ret = []
    for i in range(0, k):
        curr = []
        for j in ageser:
            if j >= bins[i] and j <= bins[i+1]:
                curr.append(j)
        # mean of curr
        ret+=[np.mean(curr)]*len(curr)
    return ret


def binning_equal_frequency(age, size):
    while len(age) % size != 0:
        age.append(0)
    age = sorted(age)
    ret = []
    for i in range(0, len(age), size):
        ret+=[np.mean(age[i:i+size])]*size
    return ret

def binning(series):
    equalWidth = binning_equal_width(series, 25)
    equalFrequency = binning_equal_frequency(series, 100)
```

```
    _, axs = plt.subplots(1,3, figsize=(18,6), sharey=True)
    axs[0].plot(series, label = 'Original Age', color='green')
    axs[0].set_title('Original Age')
    axs[1].plot(equalWidth, label = 'Equal Width Binning', color = 'cyan')
    axs[1].set_title('Equal Width Binning')
    axs[2].plot(equalFrequency, label = 'Equal Frequency Binning', color = 'blue')
    axs[2].set_title('Equal Frequency Binning')
    plt.show()

binning(titanic_df['medianfilled-age'].tolist())
```

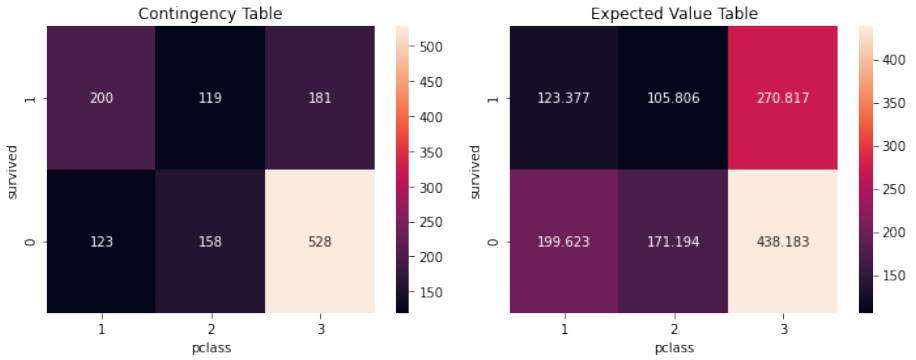


Q3. Performing Chi-Square test on the titanic dataset (and show the contingency table)

1. Pclass & Survived (fill missing values with highest frequency category, if any)
2. Pclass & sex (fill missing values with highest frequency category, if any)
3. Plass & embarked (fill missing values with highest frequency category, if any)

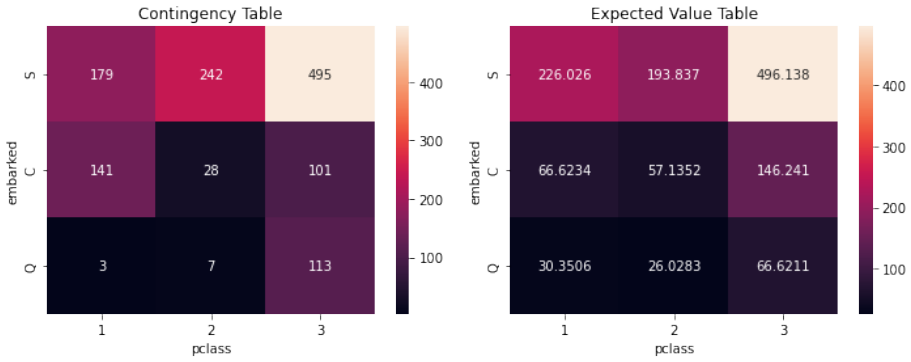
```
import seaborn as sns
from scipy.stats.distributions import chi2
def chiSquareCalc(x, y):
    x = x.fillna(x.mode()[0])
    y = y.fillna(y.mode()[0])

    table = {}
    for i in range(len(x)):
        if x[i] in table:
            if y[i] in table[x[i]]:
                table[x[i]][y[i]] += 1
            else:
                table[x[i]][y[i]] = 1
        else:
            table[x[i]] = {}
```

```
            table[x[i]][y[i]] = 1
    df = pd.DataFrame(table)
    df['Sum(row)'] = df.sum(axis=1)
    df.loc['Sum(col)'] = df.sum()
    df.columns.name = x.name
    df.index.name = y.name

    df_exp = df.copy()

    for i in range(len(df.columns)-1):
        df_exp.iloc[i, :-1] = df_exp.iloc[-1,:-1]*df_exp.iloc[i, -1]/df_exp.iloc[-1,-1]

    # Plot everything
    plt.figure(figsize=(10,4))
    plt.subplot(1,2,1)
    sns.heatmap(df.iloc[:-1, :-1], annot=True, fmt='d')
    plt.title('Contingency Table')
    plt.subplot(1,2,2)
    sns.heatmap(df_exp.iloc[:-1, :-1], annot=True, fmt='g')
    plt.title('Expected Value Table')
    plt.tight_layout()
    plt.show()

    chiSq = np.sum(np.sum(((df.iloc[:-1, :-1] - df_exp.iloc[:-1, :-1])**2/df_exp.iloc[:-1, :
    print("The chi-square value:", chiSq)
    rows = x.unique()
    cols = y.unique()
    dof = (len(rows)-1)*(len(cols)-1)
    print("The degree of freedom:", dof)
    p = chi2.sf(chiSq, dof)
    print("The p-value:", p)
chiSquareCalc(titanic_df['pclass'], titanic_df['survived'])
```



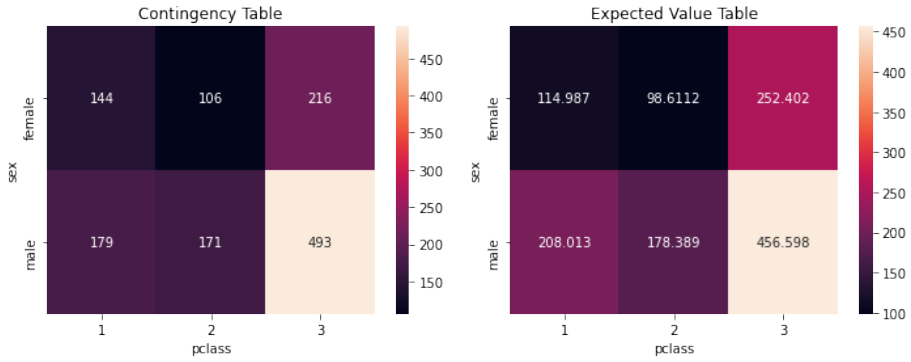
```
The chi-square value: 127.85915643930326
The degree of freedom: 2
The p-value: 1.7208259588256175e-28
```

```
chiSquareCalc(titanic_df['pclass'], titanic_df['embarked'])
```




```
The chi-square value: 204.48431967559742
The degree of freedom: 4
The p-value: 4.079916229128498e-43
```

```
chiSquareCalc(titanic_df['pclass'], titanic_df['sex'])
```



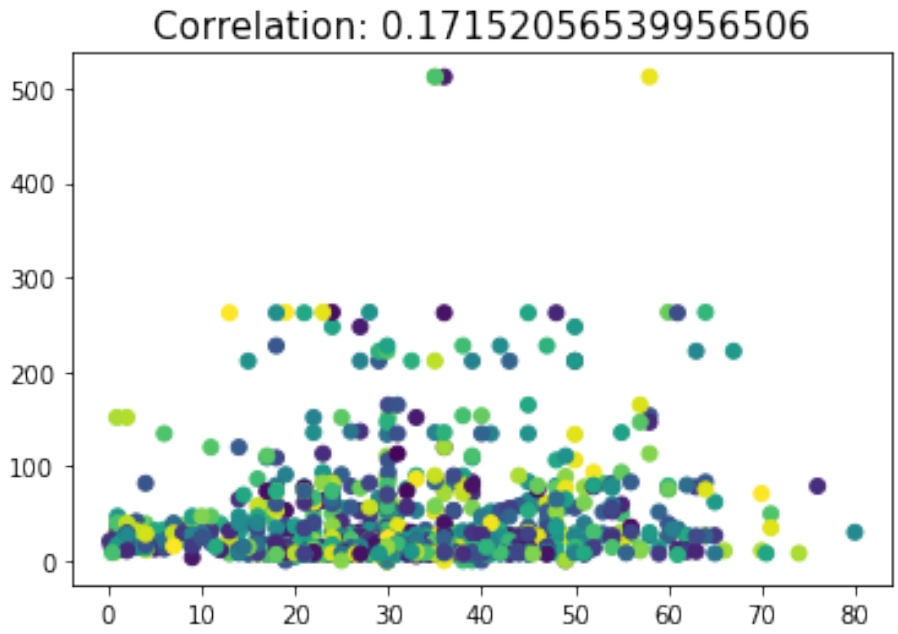

```
The chi-square value: 20.378781205085584
The degree of freedom: 2
The p-value: 3.7566772719164106e-05
```

Q4. Perform correlation analysis

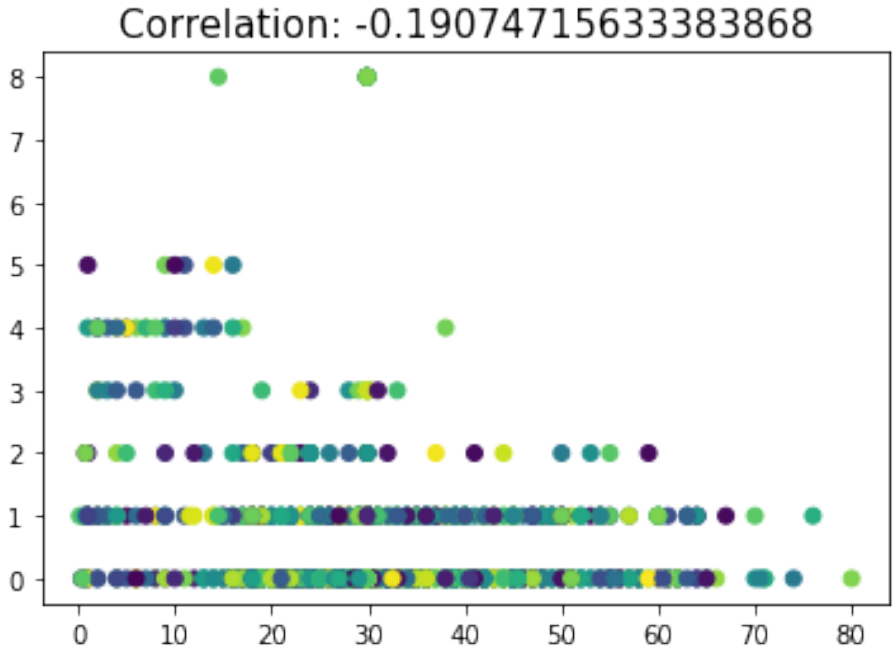
1. Age & Fare (first fill missing values using mean, if any)
2. Age & sibsp (first fill missing values using mean, if any)

```
def correlation(x, y):
    x = x.fillna(x.mean())
    y = y.fillna(y.mean())
```

```
    r = ((x-x.mean())*(y-y.mean())).sum() / ((x.size-1)*x.std()*y.std())
    plt.scatter(x, y, c=np.random.rand(x.size))
    plt.title("Correlation: "+str(r), fontsize=15)
    plt.show()

correlation(titanic_df['age'], titanic_df['fare'])
```




```
correlation(titanic_df['age'], titanic_df['sibsp'])
```


Correlation: -0.19074715633383868
8
7
6
5
4
3
2
1
0
0
10
20
30
40
50
60
70
80