```
pip install ucimlrepo
```

```
Collecting ucimlrepo
  Downloading ucimlrepo-0.0.7-py3-none-any.whl.metadata (5.5 kB)
Requirement already satisfied: pandas>=1.0.0 in /usr/local/lib/python3.11/dist-packages (from ucimlrepo) (2.2.2)
Requirement already satisfied: certifi>=2020.12.5 in /usr/local/lib/python3.11/dist-packages (from ucimlrepo) (2025.1.31)
Requirement already satisfied: numpy>=1.23.2 in /usr/local/lib/python3.11/dist-packages (from pandas>=1.0.0->ucimlrepo) (2.0.2)
Requirement already satisfied: python-dateutil>=2.8.2 in /usr/local/lib/python3.11/dist-packages (from pandas>=1.0.0->ucimlrepo) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.11/dist-packages (from pandas>=1.0.0->ucimlrepo) (2025.1)
Requirement already satisfied: tzdata>=2022.7 in /usr/local/lib/python3.11/dist-packages (from pandas>=1.0.0->ucimlrepo) (2025.1)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.11/dist-packages (from python-dateutil>=2.8.2->pandas>=1.0.0->ucimlrep
Downloading ucimlrepo-0.0.7-py3-none-any.whl (8.0 kB)
Installing collected packages: ucimlrepo
Successfully installed ucimlrepo-0.0.7
```

```
#First two steps are to bring in the data from the referenced website
from ucimlrepo import fetch_ucirepo

national_health_and_nutrition_health_survey_2013_2014_nhanes_age_prediction_subset = fetch_ucirepo(id=887)

X = national_health_and_nutrition_health_survey_2013_2014_nhanes_age_prediction_subset.data.features
y = national_health_and_nutrition_health_survey_2013_2014_nhanes_age_prediction_subset.data.targets

print(national_health_and_nutrition_health_survey_2013_2014_nhanes_age_prediction_subset.metadata)

print(national_health_and_nutrition_health_survey_2013_2014_nhanes_age_prediction_subset.variables)
```

```
{'uci_id': 887, 'name': 'National Health and Nutrition Health Survey 2013-2014 (NHANES) Age Prediction Subset', 'repository_url': 'https
        name     role         type demographic  \
0       SEQN       ID   Continuous        None
1  age_group   Target  Categorical         Age
2   RIDAGEYR    Other   Continuous         Age
3   RIAGENDR  Feature   Continuous      Gender
4     PAQ605  Feature   Continuous        None
5     BMXBMI  Feature   Continuous        None
6     LBXGLU  Feature   Continuous        None
7     DIQ010  Feature   Continuous        None
8     LBXGLT  Feature   Continuous        None
9      LBXIN  Feature   Continuous        None

                                         description units missing_values
0                         Respondent Sequence Number  None             no
1         Respondent's Age Group (senior/non-senior)  None             no
2                                   Respondent's Age  None             no
3                                Respondent's Gender  None             no
4  If the respondent engages in moderate or vigor...  None             no
5                          Respondent's Body Mass Index  None             no
6            Respondent's Blood Glucose after fasting  None             no
7                         If the Respondent is diabetic  None             no
8                                Respondent's Oral   None             no
9                    Respondent's Blood Insulin Levels  None             no
```

```
import pandas as pd
import numpy as np


#Create a dataframe with Features and Targets
national = national_health_and_nutrition_health_survey_2013_2014_nhanes_age_prediction_subset


df = pd.DataFrame(national.data.features)


df = df.assign(age_group=national.data.targets)


df = df.assign(RIDAGEYR=national.data.targets)


#Index the insulin levels to create a new column with assigned labels based off the value in the insulin column
df['Category'] = pd.cut(df['LBXIN'],
                        bins=[0, 10, 15, 30, 110],
                        labels=['Low', 'Medium', 'High', 'Very High'],
                        right=False,
                        include_lowest=True)
```

```
df.head()
```

	RIAGENDR	PAQ605	BMXBMI	LBXGLU	DIQ010	LBXGLT	LBXIN	age_group	RIDAGEYR	Category
0	2.0	2.0	35.7	110.0	2.0	150.0	14.91	Adult	Adult	Medium
1	2.0	2.0	20.3	89.0	2.0	80.0	3.85	Adult	Adult	Low
2	1.0	2.0	23.2	89.0	2.0	68.0	6.14	Adult	Adult	Low
3	1.0	2.0	28.9	104.0	2.0	84.0	16.15	Adult	Adult	High
4	2.0	1.0	35.9	103.0	2.0	81.0	10.92	Adult	Adult	Medium

Next steps: Generate code with df View recommended plots New interactive sheet

```
#Using Label encoding to change Adult and Senior into 1 and 2 for the KNN
d = {'Adult': 1, 'Senior': 2}
df['age_group'] = df['age_group'].map(d)
df['RIDAGEYR'] = df['RIDAGEYR'].map(d)
print(df)
```

```
      RIAGENDR  PAQ605  BMXBMI  LBXGLU  DIQ010  LBXGLT  LBXIN  age_group  \
0          2.0     2.0    35.7   110.0     2.0   150.0  14.91          1   
1          2.0     2.0    20.3    89.0     2.0    80.0   3.85          1   
2          1.0     2.0    23.2    89.0     2.0    68.0   6.14          1   
3          1.0     2.0    28.9   104.0     2.0    84.0  16.15          1   
4          2.0     1.0    35.9   103.0     2.0    81.0  10.92          1   
...        ...     ...     ...     ...     ...     ...    ...        ...   
2273       2.0     2.0    33.5   100.0     2.0    73.0   6.53          1   
2274       1.0     2.0    30.0    93.0     2.0   208.0  13.02          1   
2275       1.0     2.0    23.7   103.0     2.0   124.0  21.41          1   
2276       2.0     2.0    27.4    90.0     2.0   108.0   4.99          1   
2277       1.0     2.0    24.5   108.0     2.0   108.0   3.76          1   

      RIDAGEYR Category  
0            1   Medium  
1            1      Low  
2            1      Low  
3            1     High  
4            1   Medium  
...        ...      ...  
2273         1      Low  
2274         1   Medium  
2275         1     High  
2276         1      Low  
2277         1      Low  

[2278 rows x 10 columns]
```

```
import pandas
from sklearn import tree
from sklearn.tree import DecisionTreeClassifier
import matplotlib.pyplot as plt
```

```
#To give more familar names to the column headers
df.rename(columns={'RIAGENDR': 'Gender', 'PAQ605': 'Exercise', 'BMXBMI': 'BMI', 'LBXGLU': 'Glucose', 'DIQ010': 'Diabetic', 'LBXGLT': 'Oral_G
```

```
print(df)
```

```
      Gender  Exercise   BMI  Glucose  Diabetic  Oral_Glucose  Insulin  \
0        2.0       2.0  35.7    110.0       2.0         150.0    14.91   
1        2.0       2.0  20.3     89.0       2.0          80.0     3.85   
2        1.0       2.0  23.2     89.0       2.0          68.0     6.14   
3        1.0       2.0  28.9    104.0       2.0          84.0    16.15   
4        2.0       1.0  35.9    103.0       2.0          81.0    10.92   
...      ...       ...   ...      ...       ...           ...      ...   
2273     2.0       2.0  33.5    100.0       2.0          73.0     6.53   
2274     1.0       2.0  30.0     93.0       2.0         208.0    13.02   
2275     1.0       2.0  23.7    103.0       2.0         124.0    21.41   
2276     2.0       2.0  27.4     90.0       2.0         108.0     4.99   
2277     1.0       2.0  24.5    108.0       2.0         108.0     3.76   

      age_group  Age Insulin_Category  
0             1    1           Medium  
1             1    1              Low  
2             1    1              Low  
3             1    1             High  
```

```
4             1    1           Medium
...         ...  ...              ...
2273          1    1              Low
2274          1    1           Medium
2275          1    1             High
2276          1    1              Low
2277          1    1              Low

[2278 rows x 10 columns]
```

```
#Using Z-Score to detect outlier and then remove them from columns Glucose, BMI and Oral Glucose
from scipy import stats
import numpy as np
z = np.abs(stats.zscore(df['Glucose']))
print(z)
```

```
0       0.584085
1       0.590024
2       0.590024
3       0.248625
4       0.192715
          ...
2273    0.024985
2274    0.366384
2275    0.192715
2276    0.534114
2277    0.472265
Name: Glucose, Length: 2278, dtype: float64
```

```
threshold_z = 2

outlier_indices = np.where(z > threshold_z)[0]
no_outliers = df.drop(outlier_indices)
print("Original DataFrame Shape:", df.shape)
print("DataFrame Shape after Removing Outliers:", no_outliers.shape)
```

```
Original DataFrame Shape: (2278, 10)
DataFrame Shape after Removing Outliers: (2237, 10)
```

```
z = np.abs(stats.zscore(no_outliers['BMI']))
print(z)
```

```
0       1.092822
1       1.050235
2       0.646672
3       0.146537
4       1.120654
          ...
2273    0.786671
2274    0.299613
2275    0.577092
2276    0.062202
2277    0.465765
Name: BMI, Length: 2237, dtype: float64
```

```
threshold_z = 2

outlier_indices = no_outliers[z > threshold_z].index
no_outliers2 = no_outliers.drop(outlier_indices)
print("Original DataFrame Shape:", no_outliers.shape)
print("DataFrame Shape after Removing Outliers:", no_outliers2.shape)
```

```
Original DataFrame Shape: (2237, 10)
DataFrame Shape after Removing Outliers: (2132, 10)
```

```
z = np.abs(stats.zscore(no_outliers2['Oral_Glucose']))
print(z)
```

```
0       1.016329
1       0.825439
2       1.141170
3       0.720195
4       0.799128
          ...
2273    1.009616
2274    2.542365
2275    0.332244
2276    0.088732
```

```
2277    0.088732
Name: Oral_Glucose, Length: 2132, dtype: float64
```

```
threshold_z = 2

outlier_indices = no_outliers2[z > threshold_z].index
df = no_outliers2.drop(outlier_indices)
print("Original DataFrame Shape:", no_outliers2.shape)
print("DataFrame Shape after Removing Outliers:", df.shape)
```

```
Original DataFrame Shape: (2132, 10)
DataFrame Shape after Removing Outliers: (2032, 10)
```

```
print(df)
```

```
      Gender  Exercise   BMI  Glucose  Diabetic  Oral_Glucose  Insulin  \
0        2.0       2.0  35.7    110.0       2.0         150.0    14.91
1        2.0       2.0  20.3     89.0       2.0          80.0     3.85
2        1.0       2.0  23.2     89.0       2.0          68.0     6.14
3        1.0       2.0  28.9    104.0       2.0          84.0    16.15
4        2.0       1.0  35.9    103.0       2.0          81.0    10.92
...      ...       ...   ...      ...       ...           ...      ...
2272     1.0       2.0  22.5     98.0       2.0          79.0     3.51
2273     2.0       2.0  33.5    100.0       2.0          73.0     6.53
2275     1.0       2.0  23.7    103.0       2.0         124.0    21.41
2276     2.0       2.0  27.4     90.0       2.0         108.0     4.99
2277     1.0       2.0  24.5    108.0       2.0         108.0     3.76

      age_group  Age Insulin_Category
0             1    1           Medium
1             1    1              Low
2             1    1              Low
3             1    1             High
4             1    1           Medium
...         ...  ...              ...
2272          1    1              Low
2273          1    1              Low
2275          1    1             High
2276          1    1              Low
2277          1    1              Low

[2032 rows x 10 columns]
```

```
from sklearn.neighbors import KNeighborsClassifier
from sklearn.model_selection import train_test_split
from sklearn.datasets import load_iris
import numpy as np
import matplotlib.pyplot as plt
```

```
#Assign the features to the X axis without the target; assign the target to the Y
X = df.drop('Age', axis=1)
X = df.drop('Insulin_Category', axis=1)
Y = df['Insulin_Category']
```

```
#Train the test and train split
X_train, X_test, y_train, y_test = train_test_split(
             X, Y, test_size = 0.2, random_state=42)
```

```
#KNN accuracy score
knn = KNeighborsClassifier(n_neighbors=7)
knn.fit(X_train, y_train)
print(knn.score(X_test, y_test))
```

```
0.8157248157248157
```

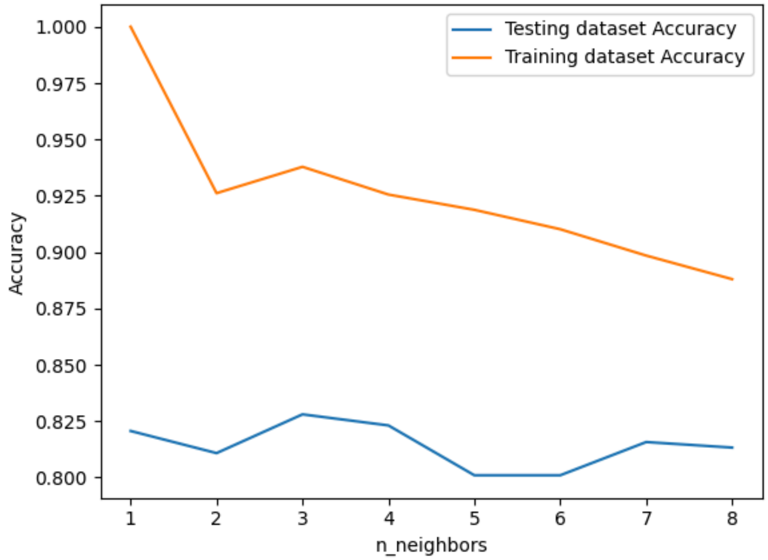
```
#run the KNN and plot for the 8 features
neighbors = np.arange(1, 9)
train_accuracy = np.empty(len(neighbors))
test_accuracy = np.empty(len(neighbors))

for i, k in enumerate(neighbors):
    knn = KNeighborsClassifier(n_neighbors=k)
    knn.fit(X_train, y_train)

    train_accuracy[i] = knn.score(X_train, y_train)
    test_accuracy[i] = knn.score(X_test, y_test)
    test_accuracy[i] = knn.score(X_test, y_test)

plt.plot(neighbors, test_accuracy, label = 'Testing dataset Accuracy')
plt.plot(neighbors, train_accuracy, label = 'Training dataset Accuracy')

plt.legend()
plt.xlabel('n_neighbors')
plt.ylabel('Accuracy')
plt.show()
```


Testing dataset Accuracy
Training dataset Accuracy
Accuracy
n_neighbors