4)Implement Naïve Bayes Classifier and K-Nearest Neighbor Classifier on Data set of your choice. Test and Compare for Accuracy and Precision.

In [9]:
```
import pandas as pd   # to load dataset
import matplotlib.pyplot as plt
import seaborn as sns
import pylab as pl
from sklearn.model_selection import train_test_split   # for splitting dataset
from sklearn.preprocessing import MinMaxScaler  # for scaling
from sklearn.linear_model import LogisticRegression   # machine learning lib/model, # get accuracy by Logistic
from sklearn.tree import DecisionTreeClassifier  # get accuracy by Decision Tree classifier
from sklearn.neighbors import KNeighborsClassifier  # get accuracy by KNN classifier
from sklearn.naive_bayes import GaussianNB # get accuracy by GNB classifier
```

In [10]:
```
df=pd.read_csv('fruit_data.csv')
```

In [11]:
```
df.shape
```

Out[11]:
```
(59, 7)
```

In [12]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 59 entries, 0 to 58
Data columns (total 7 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   fruit_label    59 non-null     int64
 1   fruit_name     59 non-null     object
 2   fruit_subtype  59 non-null     object
 3   mass           59 non-null     int64
 4   width          59 non-null     float64
 5   height         59 non-null     float64
 6   color_score    59 non-null     float64
dtypes: float64(3), int64(2), object(2)
memory usage: 3.4+ KB
```

In [13]:
```
df.describe()
```

Out[13]:

	fruit_label	mass	width	height	color_score
count	59.000000	59.000000	59.000000	59.000000	59.000000
mean	2.542373	163.118644	7.105085	7.693220	0.762881
std	1.208048	55.018832	0.816938	1.361017	0.076857
min	1.000000	76.000000	5.800000	4.000000	0.550000
25%	1.000000	140.000000	6.600000	7.200000	0.720000
50%	3.000000	158.000000	7.200000	7.600000	0.750000
75%	4.000000	177.000000	7.500000	8.200000	0.810000
max	4.000000	362.000000	9.600000	10.500000	0.930000

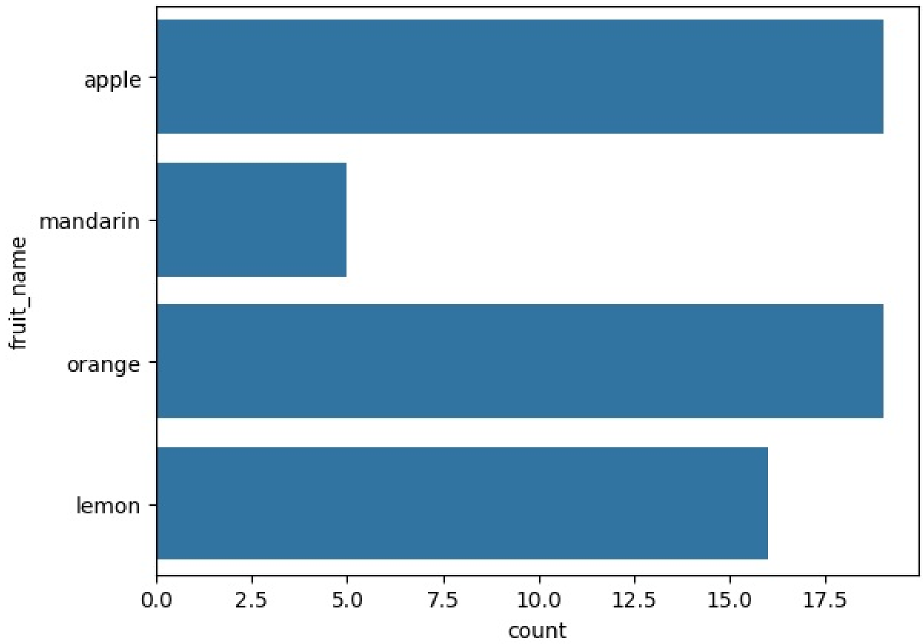
In [14]:
```
print(df['fruit_name'].unique()) # unique fruits name
```

```
['apple' 'mandarin' 'orange' 'lemon']
```

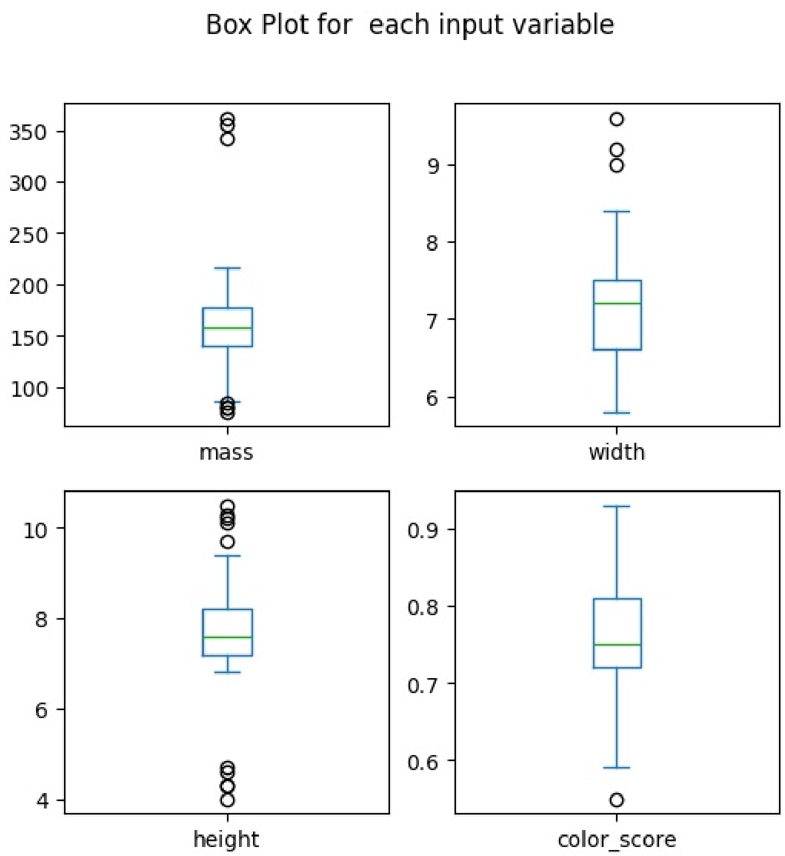
In [15]:
```
print(df['fruit_subtype'].unique()) # unique fruit subtype
```

```
['granny_smith' 'mandarin' 'braeburn' 'golden_delicious' 'cripps_pink'
 'spanish_jumbo' 'selected_seconds' 'turkey_navel' 'spanish_belsan'
 'unknown']
```

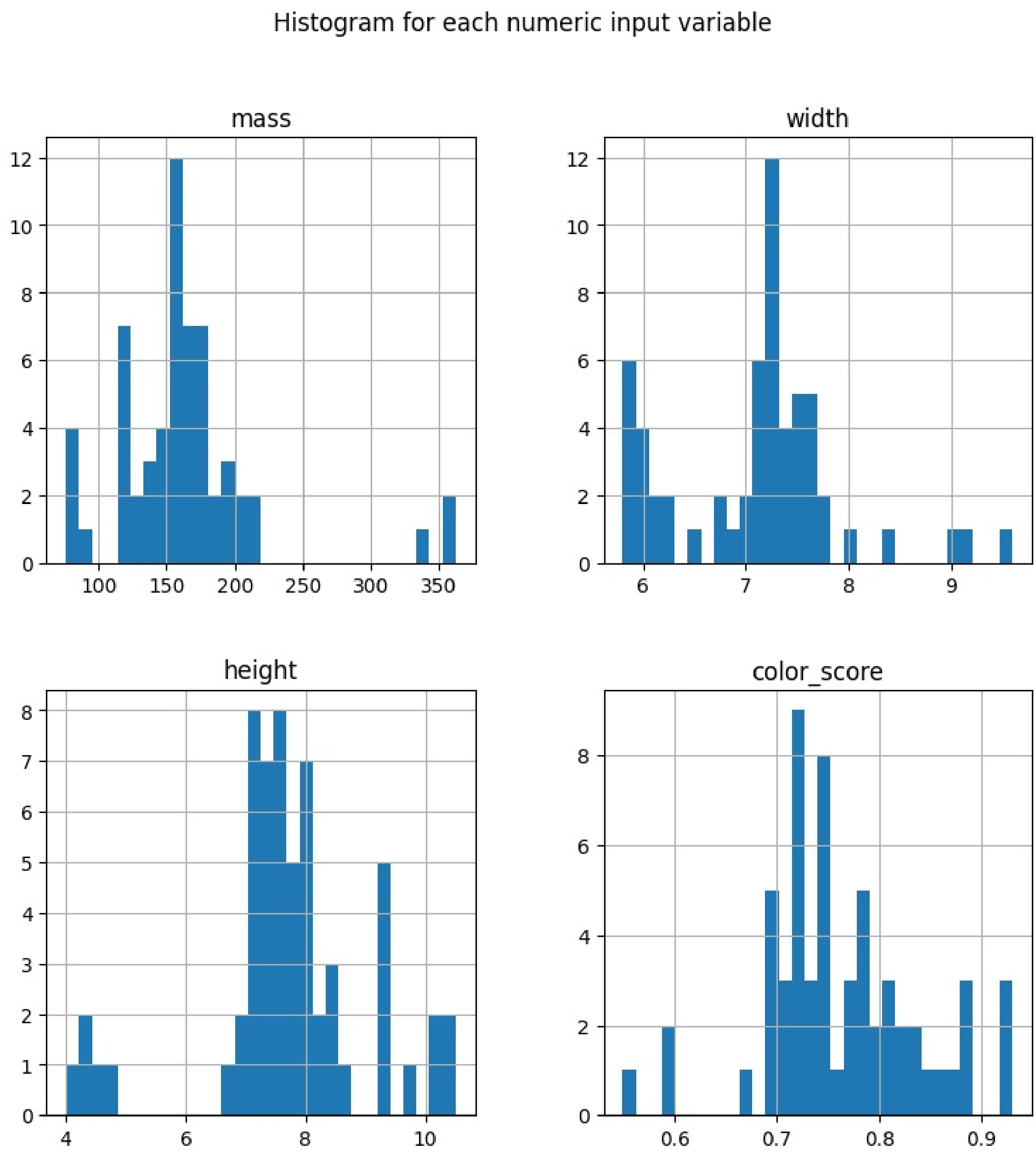
In [16]:
```
sns.countplot(df['fruit_name'],label='Count') # count plot
plt.show()
```



In [17]:
```
df.drop('fruit_label',axis=1).plot(kind='box', subplots=True, layout=(2,2), sharex=False, sharey=False, figsize
plt.savefig('fruits_box')
plt.show()
```



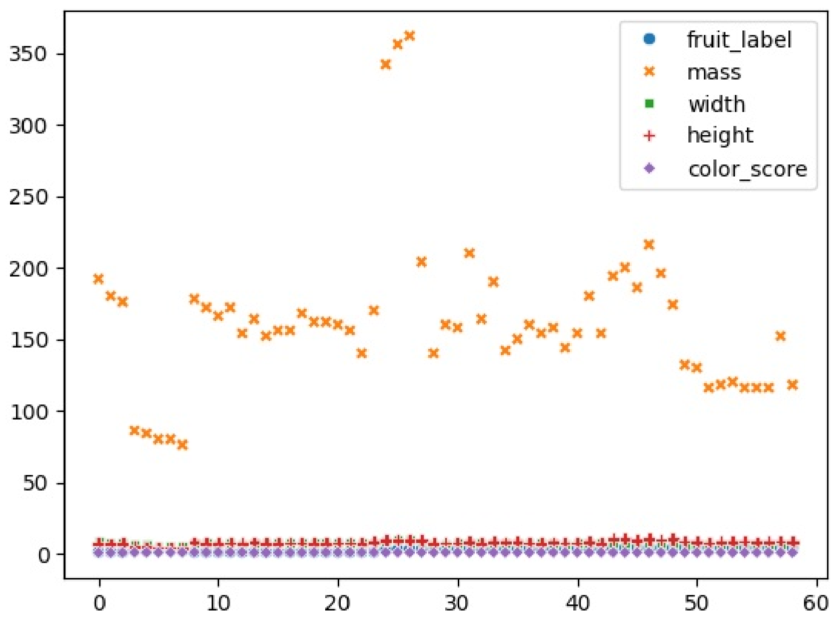
In [18]:
```
import pylab as pl

df.drop('fruit_label', axis=1).hist(bins=30, figsize=(9,9))
pl.suptitle("Histogram for each numeric input variable")
plt.savefig('fruits_hist')
```



In [19]:
```
plt.show()
```

In [20]:
```
#scaterplot
sns.scatterplot(data=df)
```

Out[20]: <Axes: >



In [21]:
```
#preparing data with scaling
import pandas as pd
```

```
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import MinMaxScaler

feature_names = ['mass', 'width', 'height', 'color_score']
x=df[feature_names]
y=df['fruit_label']

x_train, x_test, y_train, y_test = train_test_split(x,y, random_state=0)

print(x_train[:3]) # to check output

scaler = MinMaxScaler()
x_train=scaler.fit_transform(x_train)
x_test= scaler.transform(x_test)

print("\nAfter scaling\n")
print(x_train[:3]) # to check output
```

```
    mass  width  height  color_score
42   154    7.2     7.2         0.82
48   174    7.3    10.1         0.72
7     76    5.8     4.0         0.81

After scaling

[[0.27857143 0.41176471 0.49230769 0.72972973]
 [0.35       0.44117647 0.93846154 0.45945946]
 [0.         0.         0.         0.7027027 ]]
```

In [24]:

```
from sklearn.neighbors import KNeighborsClassifier

# KNN method
knn = KNeighborsClassifier()
knn.fit(x_train, y_train)

#print score of train data
print('Accuracy of KNN classifier on training set:{:.2f}'
     .format(knn.score(x_train, y_train)))

#print score of test data
print('Accuracy of KNN Classifier on test set:{:.2f}'
     .format(knn.score(x_test, y_test)))
```

```
Accuracy of KNN classifier on training set:0.95
Accuracy of KNN Classifier on test set:1.00
```

In [25]:

```
from sklearn.naive_bayes import GaussianNB

# Gaussian Naive bayes
gnb = GaussianNB()
gnb.fit(x_train, y_train)

#print score of train data
print('Accuracy of GNB classifier on training set:{:.2f}'
     .format(gnb.score(x_train, y_train)))

#print score of test data
print('Accuracy of GNB Classifier on test set:{:.2f}'
     .format(gnb.score(x_test, y_test)))
```

```
Accuracy of GNB classifier on training set:0.86
Accuracy of GNB Classifier on test set:0.67
```

apply confusin matrix

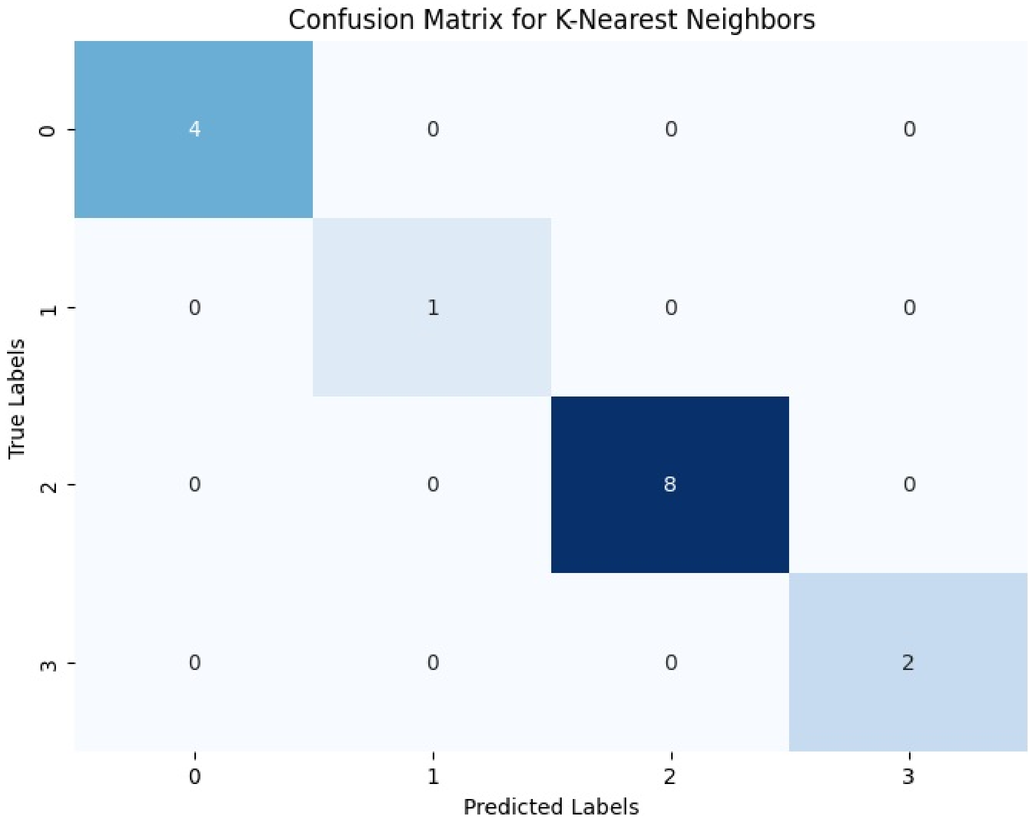
confusion matrix for KNN

In [50]:

```
import sklearn
```

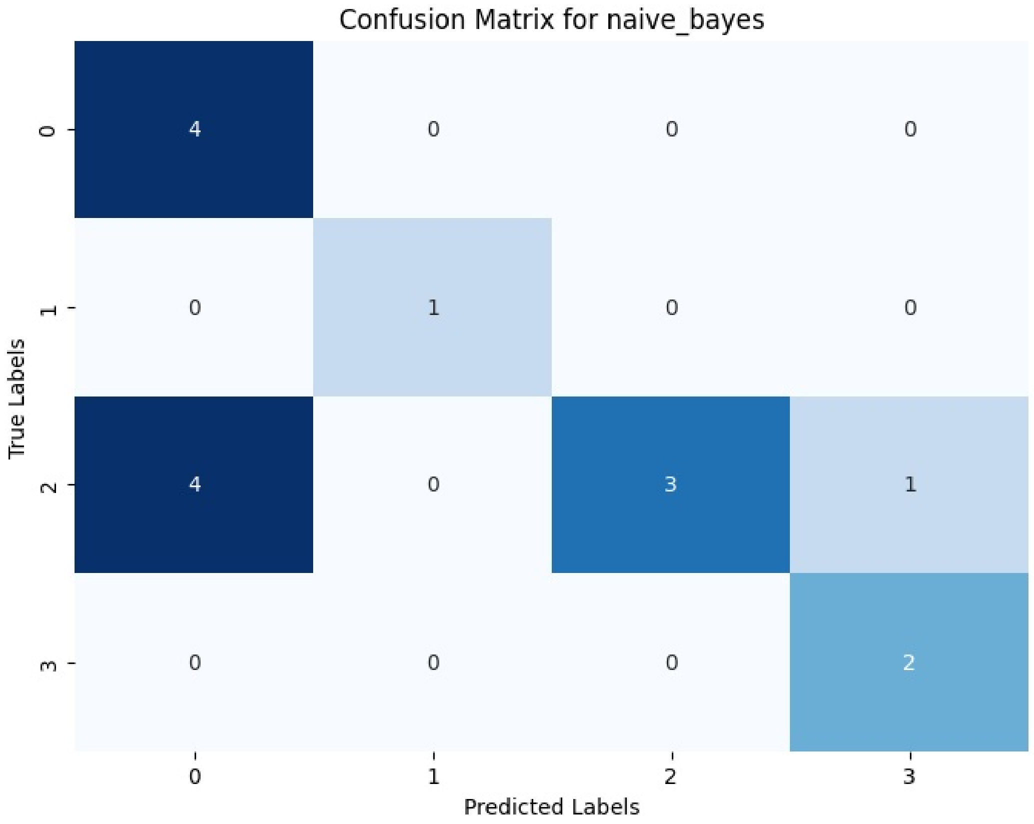
In [53]:

```
from sklearn.metrics import confusion_matrix
import seaborn as sns
import matplotlib.pyplot as plt

# Assuming you have already trained your classification models, e.g., K-Nearest Neighbors (knn)
y_pred_knn = knn.predict(x_test)  # Make predictions on the test data

# Create the confusion matrix for K-Nearest Neighbors
confusion_knn = confusion_matrix(y_test, y_pred_knn)

# Create a heatmap of the confusion matrix
plt.figure(figsize=(8, 6))
sns.heatmap(confusion_knn, annot=True, fmt='d', cmap='Blues', cbar=False)
plt.xlabel('Predicted Labels')
plt.ylabel('True Labels')
plt.title('Confusion Matrix for K-Nearest Neighbors')
plt.show()
```



confusion matrix for naive bayes

In [55]:
```
from sklearn.metrics import confusion_matrix
import seaborn as sns
import matplotlib.pyplot as plt

# Assuming you have already trained your classification models
y_pred_gnb = gnb.predict(x_test)  # Make predictions on the test data

# Create the confusion matrix
confusion_gnb = confusion_matrix(y_test, y_pred_gnb)


# Create a heatmap of the confusion matrix
plt.figure(figsize=(8, 6))
sns.heatmap(confusion_gnb, annot=True, fmt='d', cmap='Blues', cbar=False)
plt.xlabel('Predicted Labels')
plt.ylabel('True Labels')
plt.title('Confusion Matrix for naive_bayes')
plt.show()
```


Confusion Matrix for naive_bayes
True Labels
Predicted Labels
0
1
2
3
4 0 0 0
0 1 0 0
4 0 3 1
0 0 0 2

In [ ]: