In [37]:
```
import pandas as pd
a=pd.read_csv('/content/chronic kidney disease.zip')
print(a)
print(a.head())
print(a.columns)
target_variable = 'Class'
features = a.columns[a.columns != target_variable]
print('Target Variable:', target_variable)
print('Features:',features)
```

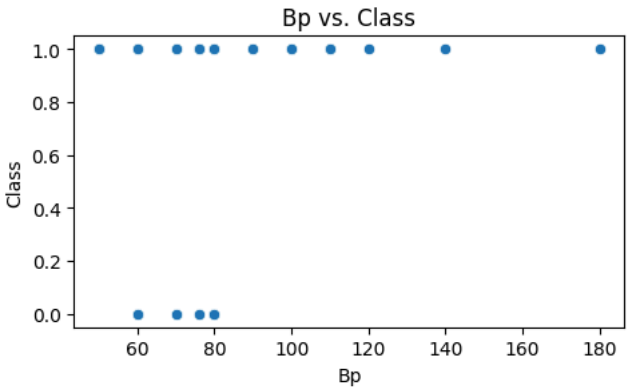
```
      Bp     Sg   Al   Su  Rbc    Bu   Sc     Sod   Pot  Hemo    Wbcc  Rbcc  \
0    80.0  1.020  1.0  0.0  1.0  36.0  1.2  137.53  4.63  15.4  7800.0  5.20
1    50.0  1.020  4.0  0.0  1.0  18.0  0.8  137.53  4.63  11.3  6000.0  4.71
2    80.0  1.010  2.0  3.0  1.0  53.0  1.8  137.53  4.63   9.6  7500.0  4.71
3    70.0  1.005  4.0  0.0  1.0  56.0  3.8  111.00  2.50  11.2  6700.0  3.90
4    80.0  1.010  2.0  0.0  1.0  26.0  1.4  137.53  4.63  11.6  7300.0  4.60
..    ...    ...  ...  ...  ...   ...  ...     ...   ...   ...     ...   ...
395  80.0  1.020  0.0  0.0  1.0  49.0  0.5  150.00  4.90  15.7  6700.0  4.90
396  70.0  1.025  0.0  0.0  1.0  31.0  1.2  141.00  3.50  16.5  7800.0  6.20
397  80.0  1.020  0.0  0.0  1.0  26.0  0.6  137.00  4.40  15.8  6600.0  5.40
398  60.0  1.025  0.0  0.0  1.0  50.0  1.0  135.00  4.90  14.2  7200.0  5.90
399  80.0  1.025  0.0  0.0  1.0  18.0  1.1  141.00  3.50  15.8  6800.0  6.10

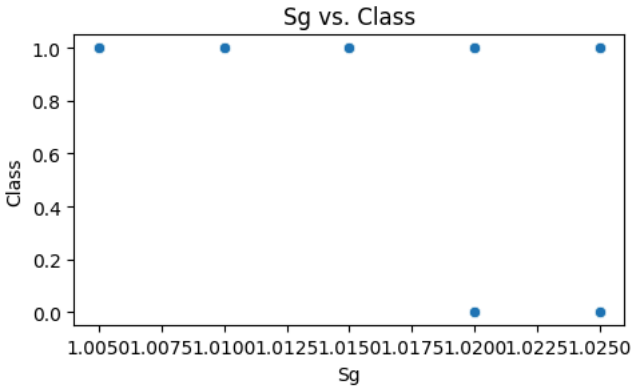
     Htn  Class
0    1.0      1
1    0.0      1
2    0.0      1
3    1.0      1
4    0.0      1
..   ...    ...
395  0.0      0
396  0.0      0
397  0.0      0
398  0.0      0
399  0.0      0

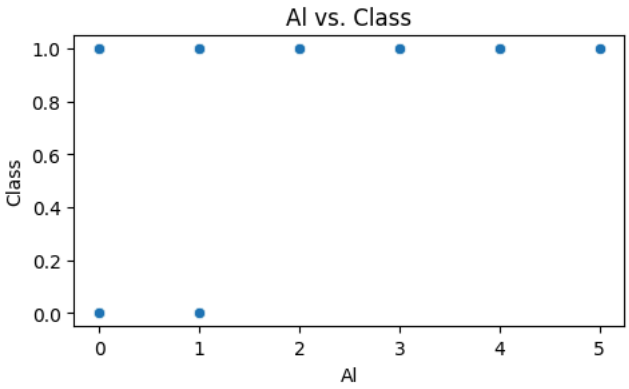
[400 rows x 14 columns]
     Bp     Sg   Al   Su  Rbc    Bu   Sc     Sod   Pot  Hemo    Wbcc  Rbcc  \
0  80.0  1.020  1.0  0.0  1.0  36.0  1.2  137.53  4.63  15.4  7800.0  5.20
1  50.0  1.020  4.0  0.0  1.0  18.0  0.8  137.53  4.63  11.3  6000.0  4.71
2  80.0  1.010  2.0  3.0  1.0  53.0  1.8  137.53  4.63   9.6  7500.0  4.71
3  70.0  1.005  4.0  0.0  1.0  56.0  3.8  111.00  2.50  11.2  6700.0  3.90
4  80.0  1.010  2.0  0.0  1.0  26.0  1.4  137.53  4.63  11.6  7300.0  4.60

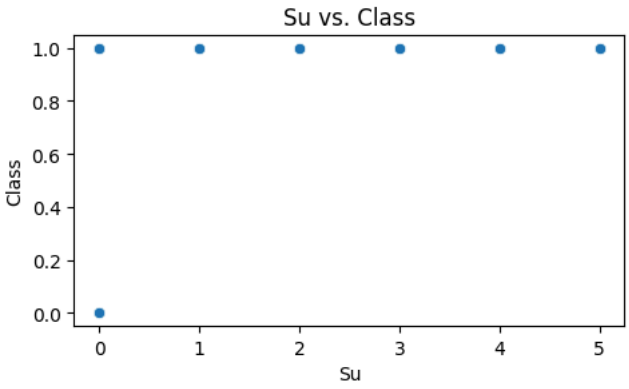
   Htn  Class
0  1.0      1
1  0.0      1
2  0.0      1
3  1.0      1
4  0.0      1
Index(['Bp', 'Sg', 'Al', 'Su', 'Rbc', 'Bu', 'Sc', 'Sod', 'Pot', 'Hemo', 'Wbcc',
       'Rbcc', 'Htn', 'Class'],
      dtype='object')
Target Variable: Class
Features: Index(['Bp', 'Sg', 'Al', 'Su', 'Rbc', 'Bu', 'Sc', 'Sod', 'Pot', 'Hemo', 'Wbcc',
       'Rbcc', 'Htn'],
      dtype='object')
```

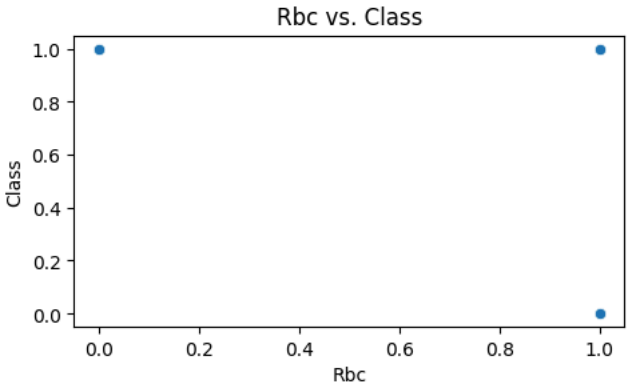
In [38]:
```
import matplotlib.pyplot as plt
import seaborn as sns
target_variable = 'Class'
feature_names = [col for col in a.columns if col != target_variable]
num_plots = len(feature_names)
fig, axes = plt.subplots(num_plots, 1, figsize=(5, 3*num_plots))
for i, feature in enumerate(feature_names):
    sns.scatterplot(data=a, x=feature, y=target_variable, ax=axes[i])
    axes[i].set_title(f'{feature} vs. {target_variable}')
plt.tight_layout()
plt.show()
```

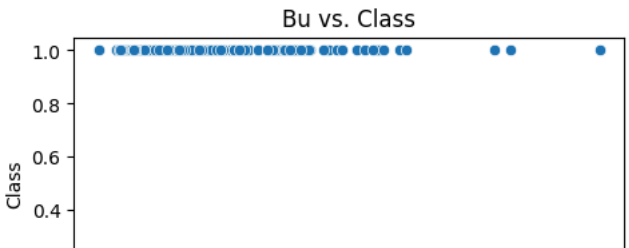

Bp vs. Class
Class
Bp
1.0
0.8
0.6
0.4
0.2
0.0
60
80
100
120
140
160
180

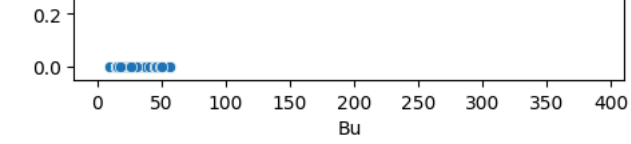

Sg vs. Class
Class
Sg
1.0
0.8
0.6
0.4
0.2
0.0
1.0050
1.0075
1.0100
1.0125
1.0150
1.0175
1.0200
1.0225
1.0250

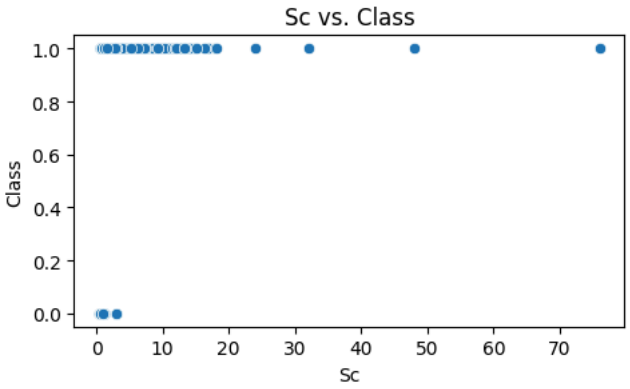

Al vs. Class
Class
Al
1.0
0.8
0.6
0.4
0.2
0.0
0
1
2
3
4
5

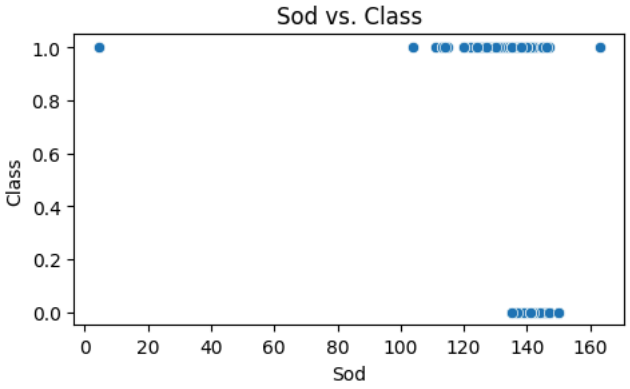

Su vs. Class
Class
Su
1.0
0.8
0.6
0.4
0.2
0.0
0
1
2
3
4
5

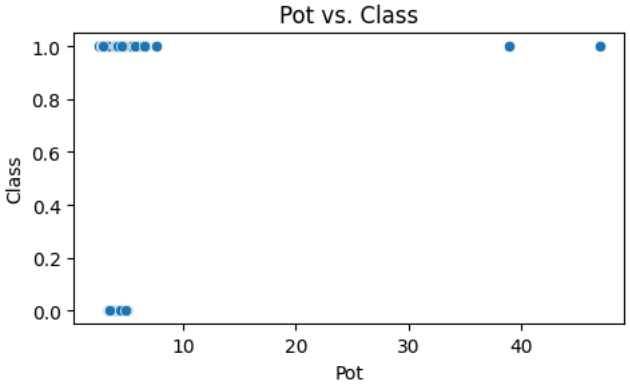

Rbc vs. Class
Class
Rbc
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0

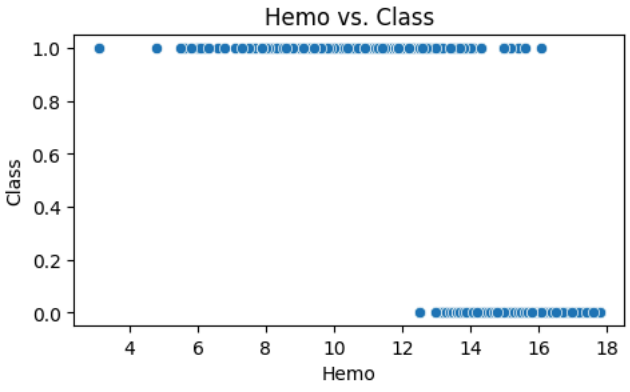

Bu vs. Class
Class
1.0
0.8
0.6
0.4

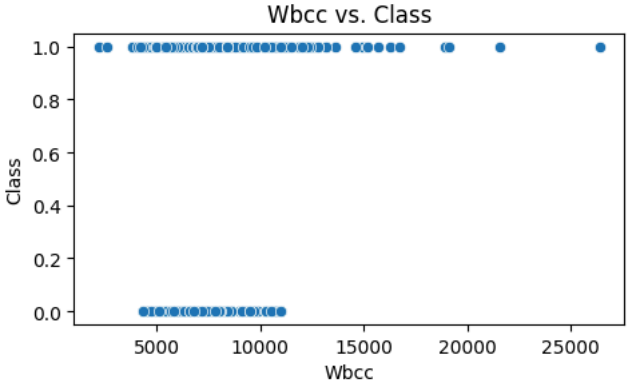

0.2
0.0
0
50
100
150
200
250
300
350
400
Bu

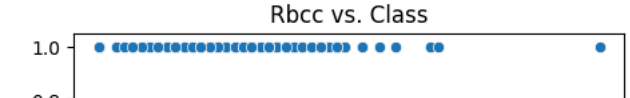

Sc vs. Class
Class
1.0
0.8
0.6
0.4
0.2
0.0
0
10
20
30
40
50
60
70
Sc

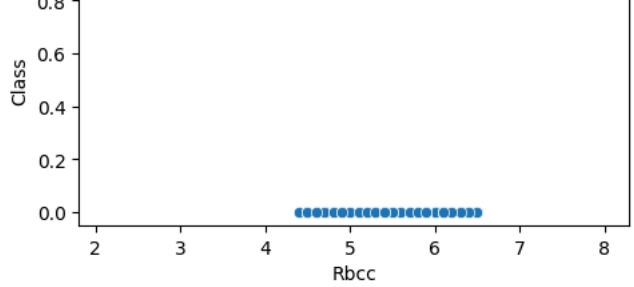

Sod vs. Class
Class
1.0
0.8
0.6
0.4
0.2
0.0
0
20
40
60
80
100
120
140
160
Sod

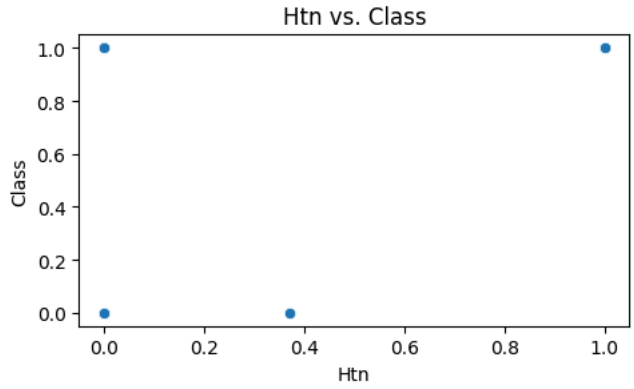

Pot vs. Class
Class
1.0
0.8
0.6
0.4
0.2
0.0
10
20
30
40
Pot


Hemo vs. Class
Class
1.0
0.8
0.6
0.4
0.2
0.0
4
6
8
10
12
14
16
18
Hemo


Wbcc vs. Class
Class
1.0
0.8
0.6
0.4
0.2
0.0
5000
10000
15000
20000
25000
Wbcc


Rbcc vs. Class
1.0





In [39]:
```
y=a['Class']
y
```

Out [39]:
```
0      1
1      1
2      1
3      1
4      1
      ..
395    0
396    0
397    0
398    0
399    0
Name: Class, Length: 400, dtype: int64
```

In [40]:
```
X=a.drop('Class',axis=1)
X
```

Out [40]:

	Bp	Sg	Al	Su	Rbc	Bu	Sc	Sod	Pot	Hemo	Wbcc	Rbcc	Htn
0	80.0	1.020	1.0	0.0	1.0	36.0	1.2	137.53	4.63	15.4	7800.0	5.20	1.0
1	50.0	1.020	4.0	0.0	1.0	18.0	0.8	137.53	4.63	11.3	6000.0	4.71	0.0
2	80.0	1.010	2.0	3.0	1.0	53.0	1.8	137.53	4.63	9.6	7500.0	4.71	0.0
3	70.0	1.005	4.0	0.0	1.0	56.0	3.8	111.00	2.50	11.2	6700.0	3.90	1.0
4	80.0	1.010	2.0	0.0	1.0	26.0	1.4	137.53	4.63	11.6	7300.0	4.60	0.0
...	...	...	...	...	...	...	...	...	...	...	...	...	...
395	80.0	1.020	0.0	0.0	1.0	49.0	0.5	150.00	4.90	15.7	6700.0	4.90	0.0
396	70.0	1.025	0.0	0.0	1.0	31.0	1.2	141.00	3.50	16.5	7800.0	6.20	0.0
397	80.0	1.020	0.0	0.0	1.0	26.0	0.6	137.00	4.40	15.8	6600.0	5.40	0.0
398	60.0	1.025	0.0	0.0	1.0	50.0	1.0	135.00	4.90	14.2	7200.0	5.90	0.0
399	80.0	1.025	0.0	0.0	1.0	18.0	1.1	141.00	3.50	15.8	6800.0	6.10	0.0

400 rows × 13 columns

In [41]:
```
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.3)
```

In [42]:
```
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score, classification_report, confusion_matrix
model = LogisticRegression()
model.fit(X_train, y_train)
y_pred = model.predict(X_test)
accuracy = accuracy_score(y_test, y_pred)
print("Accuracy:", accuracy)
```

```
Accuracy: 0.975
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/linear_model/_logistic.py:458: ConvergenceWarning: lbfgs failed to
converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.
```

```
Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression
  n_iter_i = _check_optimize_result(
```

In [43]:
```
print("\nClassification Report:")
print(classification_report(y_test, y_pred))
```

```
Classification Report:
              precision    recall  f1-score   support

           0       0.95      1.00      0.97        56
           1       1.00      0.95      0.98        64

    accuracy                           0.97       120
   macro avg       0.97      0.98      0.97       120
weighted avg       0.98      0.97      0.98       120
```

In [44]:
```
print("\nConfusion Matrix:")
print(confusion_matrix(y_test, y_pred))
```

```
Confusion Matrix:
[[56  0]
 [ 3 61]]
```

In [45]:
```
correlation_matrix = a.corr()
print("Correlation Matrix:")
print(correlation_matrix)
```

```
Correlation Matrix:
                Bp        Sg        Al        Su       Rbc        Bu        Sc  \
Bp        1.000000 -0.164057  0.146060  0.190277 -0.151478  0.184173  0.144469
Sg       -0.164057  1.000000 -0.460835 -0.292053  0.253894 -0.249263 -0.176141
Al        0.146060 -0.460835  1.000000  0.262564 -0.374484  0.405035  0.229396
Su        0.190277 -0.292053  0.262564  1.000000 -0.092940  0.126074  0.094568
Rbc      -0.151478  0.253894 -0.374484 -0.092940  1.000000 -0.236270 -0.138391
Bu        0.184173 -0.249263  0.405035  0.126074 -0.236270  1.000000  0.581176
Sc        0.144469 -0.176141  0.229396  0.094568 -0.138391  0.581176  1.000000
Sod      -0.103383  0.217456 -0.270709 -0.053448  0.140568 -0.307357 -0.624493
Pot       0.066791 -0.063450  0.114484  0.180098  0.018164  0.336954  0.205361
Hemo     -0.279441  0.492103 -0.548681 -0.156875  0.280991 -0.540699 -0.342053
Wbcc      0.025963 -0.206880  0.200664  0.159033 -0.002205  0.041530 -0.005420
Rbcc     -0.220827  0.443437 -0.454131 -0.163825  0.202298 -0.465947 -0.323056
Htn       0.268003 -0.318956  0.478309  0.253179 -0.139342  0.387503  0.273904
Class     0.290145 -0.659504  0.598389  0.294555 -0.282642  0.371982  0.294076

                Sod       Pot      Hemo      Wbcc      Rbcc       Htn     Class
Bp       -0.103383  0.066791 -0.279441  0.025963 -0.220827  0.268003  0.290145
Sg        0.217456 -0.063450  0.492103 -0.206880  0.443437 -0.318956 -0.659504
Al       -0.270709  0.114484 -0.548681  0.200664 -0.454131  0.478309  0.598389
Su       -0.053448  0.180098 -0.156875  0.159033 -0.163825  0.253179  0.294555
Rbc       0.140568  0.018164  0.280991 -0.002205  0.202298 -0.139342 -0.282642
Bu       -0.307357  0.336954 -0.540699  0.041530 -0.465947  0.387503  0.371982
Sc       -0.624493  0.205361 -0.342053 -0.005420 -0.323056  0.273904  0.294076
Sod       1.000000  0.067414  0.333604  0.006334  0.316883 -0.306501 -0.342268
Pot       0.067414  1.000000 -0.100612 -0.074057 -0.120418  0.057028  0.077063
Hemo      0.333604 -0.100612  1.000000 -0.153806  0.681864 -0.576932 -0.729537
Wbcc      0.006334 -0.074057 -0.153806  1.000000 -0.151380  0.123790  0.205266
Rbcc      0.316883 -0.120418  0.681864 -0.151380  1.000000 -0.527051 -0.590248
Htn      -0.306501  0.057028 -0.576932  0.123790 -0.527051  1.000000  0.586340
Class    -0.342268  0.077063 -0.729537  0.205266 -0.590248  0.586340  1.000000
```

In [46]:
```
from sklearn import svm
svm_model = svm.SVC(kernel='linear')
svm_model.fit(X_train, y_train)
y_pred = svm_model.predict(X_test)
accuracy = accuracy_score(y_test, y_pred)
print("Accuracy:", accuracy)
```

```
Accuracy: 0.9333333333333333
```

In [47]:
```
from sklearn.linear_model import Perceptron
perceptron_model = Perceptron()
perceptron_model.fit(X_train, y_train)
y_pred = perceptron_model.predict(X_test)
accuracy = accuracy_score(y_test, y_pred)
print("Accuracy:", accuracy)
```

```
Accuracy: 0.5333333333333333
```

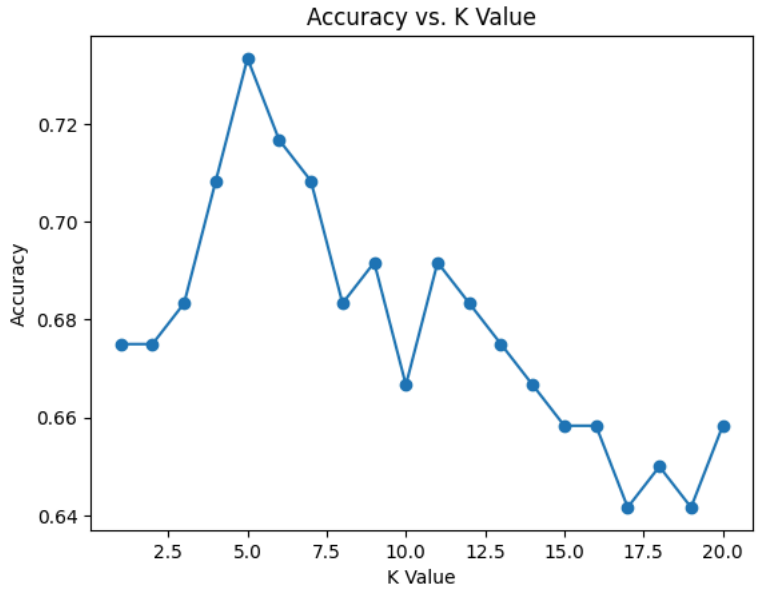
In [48]:
```
from sklearn.neighbors import KNeighborsClassifier
k_values = list(range(1, 21))
accuracies = []
for k in k_values:
    knn = KNeighborsClassifier(n_neighbors=k)
    knn.fit(X_train, y_train)
```

```
    accuracy = knn.score(X_test, y_test)
    accuracies.append(accuracy)
```

In [49]:
```
print(accuracies)
```

```
[0.675, 0.675, 0.6833333333333333, 0.7083333333333334, 0.7333333333333333, 0.7166666666666667, 0.7083333333333334, 0.6833333333333333,
```

In [50]:
```
plt.plot(k_values, accuracies, marker='o', linestyle='-')
plt.title('Accuracy vs. K Value')
plt.xlabel('K Value')
plt.ylabel('Accuracy')
plt.show()
```



In [51]:
```
from sklearn.tree import DecisionTreeClassifier
clf = DecisionTreeClassifier()
clf.fit(X_train, y_train)
y_pred = clf.predict(X_test)
accuracy = accuracy_score(y_test, y_pred)
print("Accuracy:", accuracy)
```

```
Accuracy: 0.975
```

In [52]:
```
import matplotlib.pyplot as plt
from sklearn.utils import resample
def bootstrap_accuracy(model, X_train, y_train, X_test, y_test, n_iterations):
    accuracies = []
    for i in range(n_iterations):
      X_resampled, y_resampled = resample(X_train, y_train, random_state=i)
      model.fit(X_resampled, y_resampled)
      y_pred = model.predict(X_test)
      accuracy = accuracy_score(y_test, y_pred)
      accuracies.append(accuracy)
    return accuracies
```

In [53]:
```
models = {
    'Logistic Regression': LogisticRegression(),
    'SVM': SVC(),
    'Perceptron': Perceptron(),
    'KNN': KNeighborsClassifier(),
    'Decision Tree': DecisionTreeClassifier()
}
```

In [54]:
```
n_iterations = 100
for model_name, model in models.items():
    accuracies = bootstrap_accuracy(model, X_train, y_train, X_test, y_test, n_iterations)
    plt.plot(range(1, n_iterations + 1), accuracies, label=model_name)
plt.xlabel('Number of Iterations')
plt.ylabel('Accuracy')
plt.title('Bootstrap Accuracy vs Number of Iterations for Each Model')
```

```
plt.legend()
plt.show()
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/linear_model/_logistic.py:458: ConvergenceWarning: lbfgs failed to
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STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
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Please also refer to the documentation for alternative solver options:
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