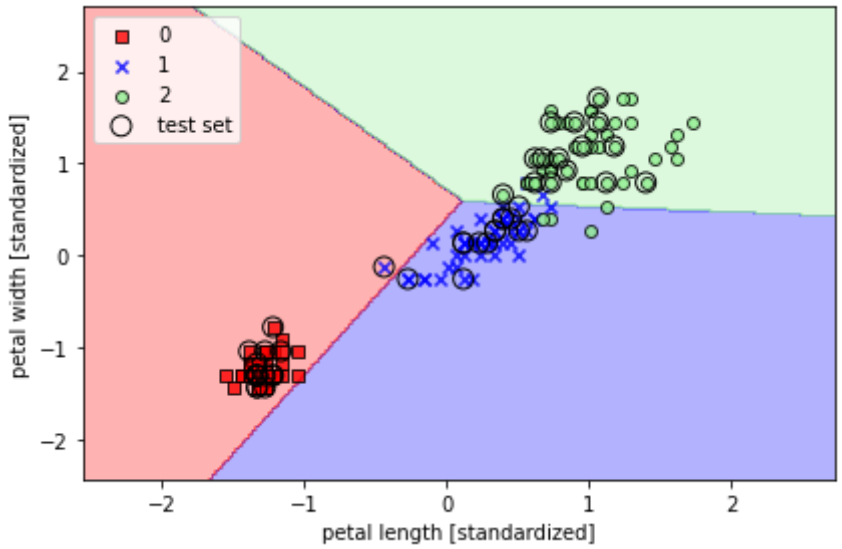
In [ ]:

```
X_combined_std = np.vstack((X_train_std, X_test_std))
y_combined = np.hstack((y_train, y_test))

plot_decision_regions(X=X_combined_std, y=y_combined,
                      classifier=ppn, test_idx=range(105, 150))
plt.xlabel('petal length [standardized]')
plt.ylabel('petal width [standardized]')
plt.legend(loc='upper left')

plt.tight_layout()
#plt.savefig('images/03_01.png', dpi=300)
plt.show()
```



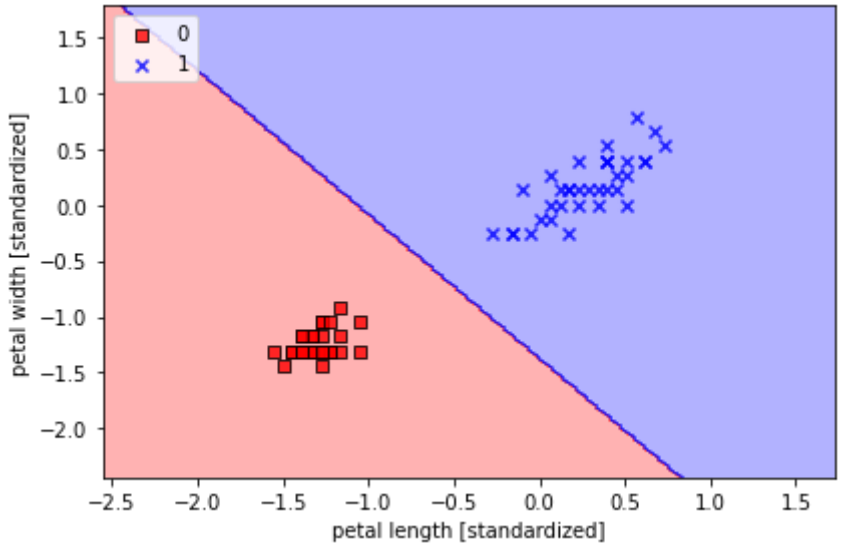
In [ ]:

```
#3章 パーセプトロン
```

```
              precision    recall  f1-score   support

           0       0.94      1.00      0.97        15
           1       1.00      0.93      0.97        15
           2       1.00      1.00      1.00        15

    accuracy                           0.98        45
   macro avg       0.98      0.98      0.98        45
weighted avg       0.98      0.98      0.98        45
```

In [ ]:

```
X_train_01_subset = X_train_std[(y_train == 0) | (y_train == 1)]
y_train_01_subset = y_train[(y_train == 0) | (y_train == 1)]

lrgd = LogisticRegressionGD(eta=0.05, n_iter=1000, random_state=1)
lrgd.fit(X_train_01_subset,
         y_train_01_subset)

plot_decision_regions(X=X_train_01_subset,
                      y=y_train_01_subset,
                      classifier=lrgd)

plt.xlabel('petal length [standardized]')
plt.ylabel('petal width [standardized]')
plt.legend(loc='upper left')

plt.tight_layout()
#plt.savefig('images/03_05.png', dpi=300)
plt.show()
```



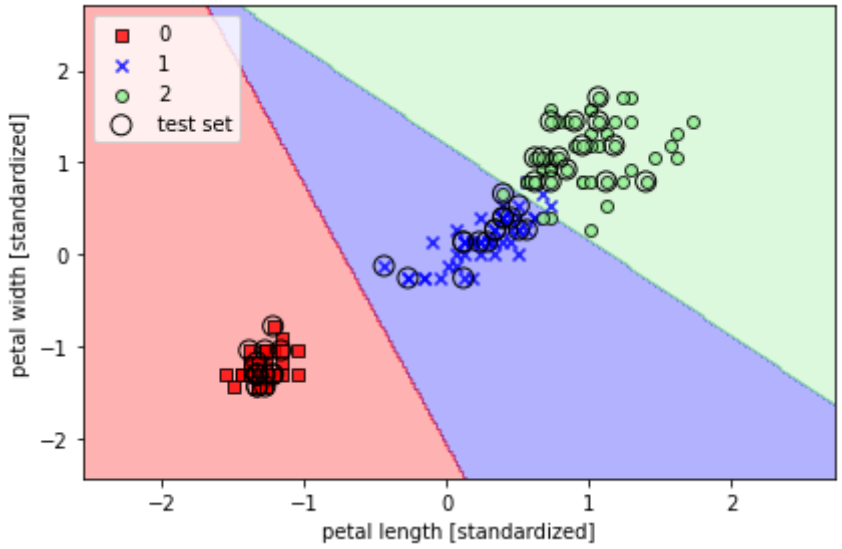
In [ ]:

ロジスティック回帰 2値

```
              precision    recall  f1-score   support

           0       0.94      1.00      0.97        15
           1       1.00      0.93      0.97        15
           2       1.00      1.00      1.00        15

    accuracy                           0.98        45
   macro avg       0.98      0.98      0.98        45
weighted avg       0.98      0.98      0.98        45

<class 'str'>
```

In [ ]:

```
from sklearn.linear_model import LogisticRegression

lr = LogisticRegression(C=100.0, random_state=1, solver='lbfgs', multi_class='ovr')
lr.fit(X_train_std, y_train)

plot_decision_regions(X_combined_std, y_combined,
                      classifier=lr, test_idx=range(105, 150))
plt.xlabel('petal length [standardized]')
plt.ylabel('petal width [standardized]')
plt.legend(loc='upper left')
plt.tight_layout()
# plt.savefig('images/03_06.png', dpi=300)
plt.show()
```



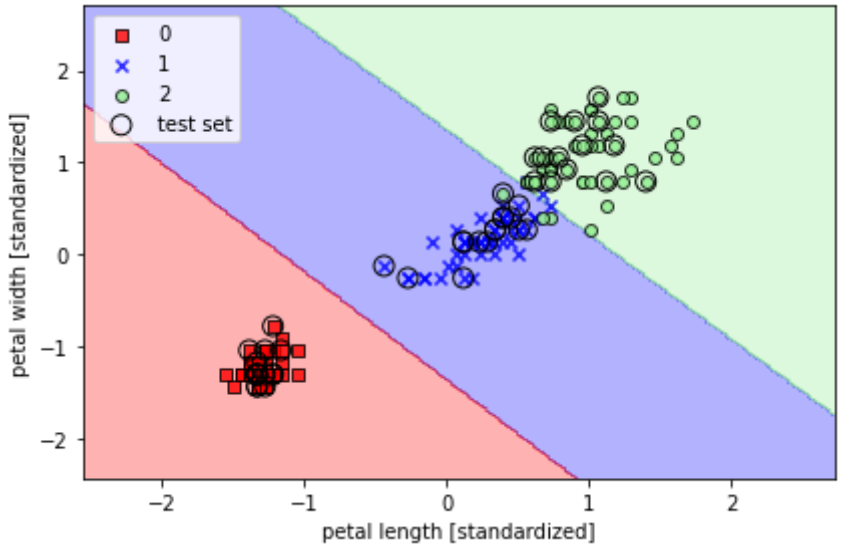
In [ ]:

```
#ロジスティック回帰 多クラス
```

```
              precision    recall  f1-score   support

           0       0.94      1.00      0.97        15
           1       1.00      0.93      0.97        15
           2       1.00      1.00      1.00        15

    accuracy                           0.98        45
   macro avg       0.98      0.98      0.98        45
weighted avg       0.98      0.98      0.98        45

<class 'str'>
```

In [ ]:

```
from sklearn.svm import SVC

svm = SVC(kernel='linear', C=1.0, random_state=1)
svm.fit(X_train_std, y_train)

plot_decision_regions(X_combined_std,
                      y_combined,
                      classifier=svm,
                      test_idx=range(105, 150))
plt.xlabel('petal length [standardized]')
plt.ylabel('petal width [standardized]')
plt.legend(loc='upper left')
plt.tight_layout()
#plt.savefig('images/03_11.png', dpi=300)
plt.show()
```



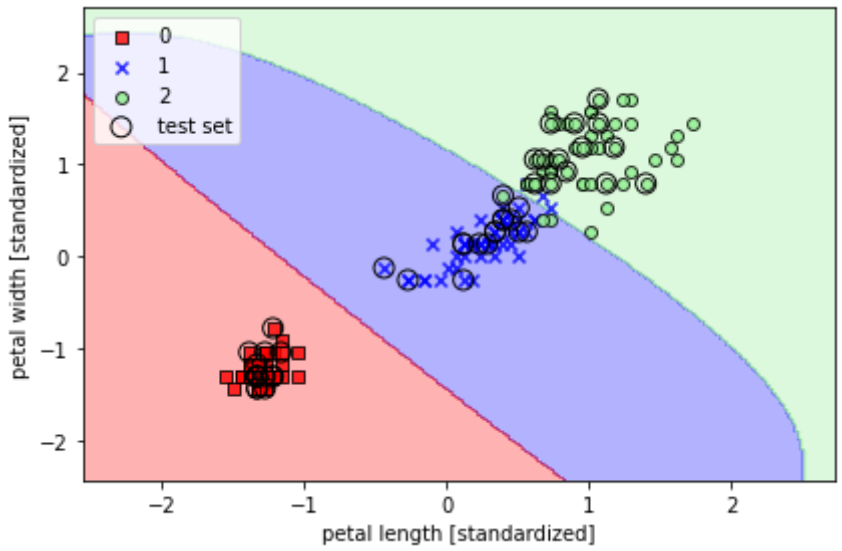
In [ ]:

```
#SVC
from sklearn.metrics import classification_report
import pandas as pd
import pprint

print(classification_report(y_test, y_pred))

print(type(classification_report(y_test, y_pred)))
```

```
              precision    recall  f1-score   support

           0       0.94      1.00      0.97        15
           1       1.00      0.93      0.97        15
           2       1.00      1.00      1.00        15

    accuracy                           0.98        45
   macro avg       0.98      0.98      0.98        45
weighted avg       0.98      0.98      0.98        45

<class 'str'>
```

In [ ]:

```
from sklearn.svm import SVC

svm = SVC(kernel='rbf', random_state=1, gamma=0.2, C=1.0)
svm.fit(X_train_std, y_train)

plot_decision_regions(X_combined_std, y_combined,
                      classifier=svm, test_idx=range(105, 150))
plt.xlabel('petal length [standardized]')
plt.ylabel('petal width [standardized]')
plt.legend(loc='upper left')
plt.tight_layout()
#plt.savefig('images/03_15.png', dpi=300)
plt.show()
```



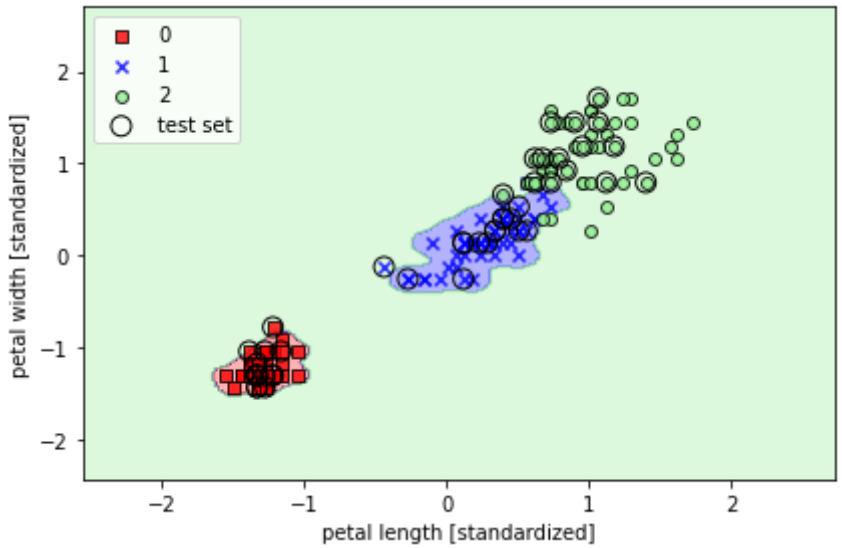
In [ ]:

```
from sklearn.metrics import classification_report
import pandas as pd
import pprint

print(classification_report(y_test, y_pred))

print(type(classification_report(y_test, y_pred)))
```

```
              precision    recall  f1-score   support

           0       0.94      1.00      0.97        15
           1       1.00      0.93      0.97        15
           2       1.00      1.00      1.00        15

    accuracy                           0.98        45
   macro avg       0.98      0.98      0.98        45
weighted avg       0.98      0.98      0.98        45

<class 'str'>
```

In [ ]:

```
svm = SVC(kernel='rbf', random_state=1, gamma=100.0, C=1.0)
svm.fit(X_train_std, y_train)

plot_decision_regions(X_combined_std, y_combined,
                      classifier=svm, test_idx=range(105, 150))
plt.xlabel('petal length [standardized]')
plt.ylabel('petal width [standardized]')
plt.legend(loc='upper left')
plt.tight_layout()
#plt.savefig('images/03_16.png', dpi=300)
plt.show()
```



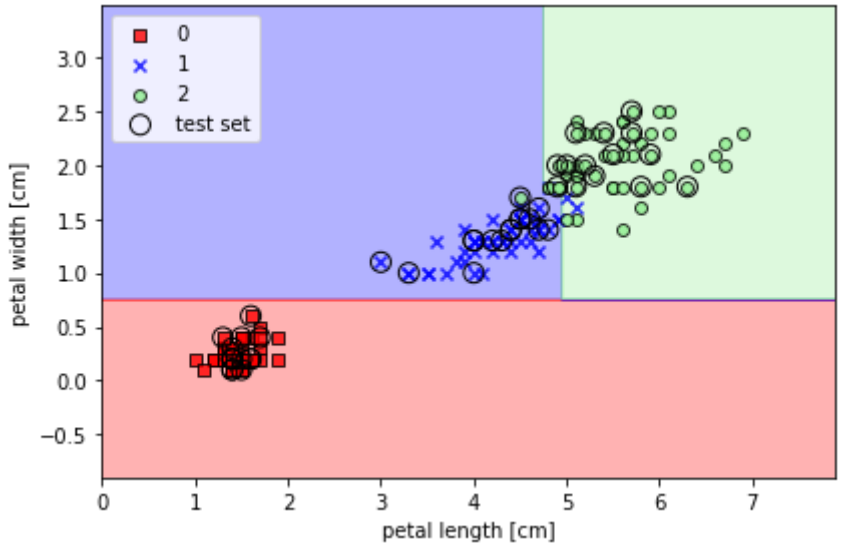
In [ ]:

```
from sklearn.metrics import classification_report
import pandas as pd
import pprint

print(classification_report(y_test, y_pred))

print(type(classification_report(y_test, y_pred)))
```

```
              precision    recall  f1-score   support

           0       0.94      1.00      0.97        15
           1       1.00      0.93      0.97        15
           2       1.00      1.00      1.00        15

    accuracy                           0.98        45
   macro avg       0.98      0.98      0.98        45
weighted avg       0.98      0.98      0.98        45

<class 'str'>
```

In [ ]:

```
from sklearn.tree import DecisionTreeClassifier

tree_model = DecisionTreeClassifier(criterion='gini',
                                    max_depth=4,
                                    random_state=1)
tree_model.fit(X_train, y_train)

X_combined = np.vstack((X_train, X_test))
y_combined = np.hstack((y_train, y_test))
plot_decision_regions(X_combined, y_combined,
                      classifier=tree_model,
                      test_idx=range(105, 150))

plt.xlabel('petal length [cm]')
plt.ylabel('petal width [cm]')
plt.legend(loc='upper left')
plt.tight_layout()
#plt.savefig('images/03_20.png', dpi=300)
plt.show()
```



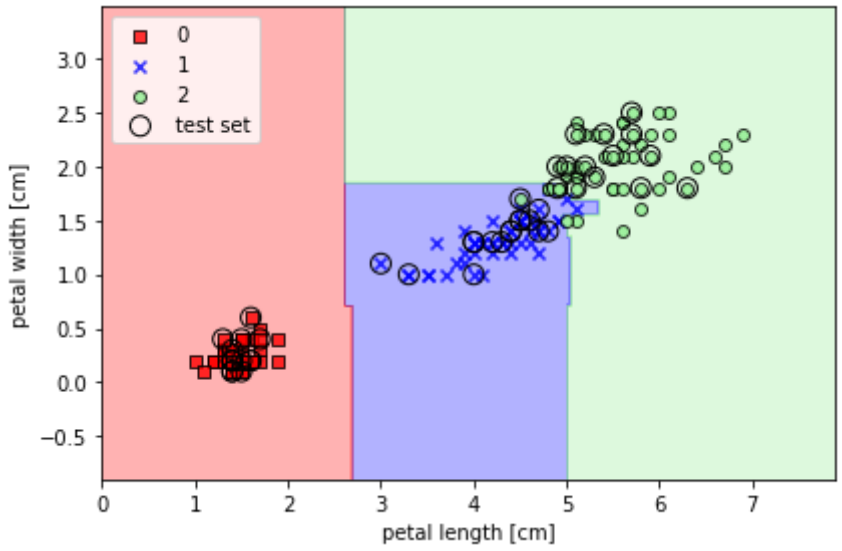
In [ ]:

```
from sklearn.metrics import classification_report
import pandas as pd
import pprint

print(classification_report(y_test, y_pred))

print(type(classification_report(y_test, y_pred)))
```

```
              precision    recall  f1-score   support

           0       0.94      1.00      0.97        15
           1       1.00      0.93      0.97        15
           2       1.00      1.00      1.00        15

    accuracy                           0.98        45
   macro avg       0.98      0.98      0.98        45
weighted avg       0.98      0.98      0.98        45

<class 'str'>
```

In [ ]:

```
from sklearn.ensemble import RandomForestClassifier

forest = RandomForestClassifier(criterion='gini',
                                n_estimators=25,
                                random_state=1,
                                n_jobs=2)
forest.fit(X_train, y_train)

plot_decision_regions(X_combined, y_combined,
                      classifier=forest, test_idx=range(105, 150))

plt.xlabel('petal length [cm]')
plt.ylabel('petal width [cm]')
plt.legend(loc='upper left')
plt.tight_layout()
#plt.savefig('images/03_22.png', dpi=300)
plt.show()
```



In [ ]:

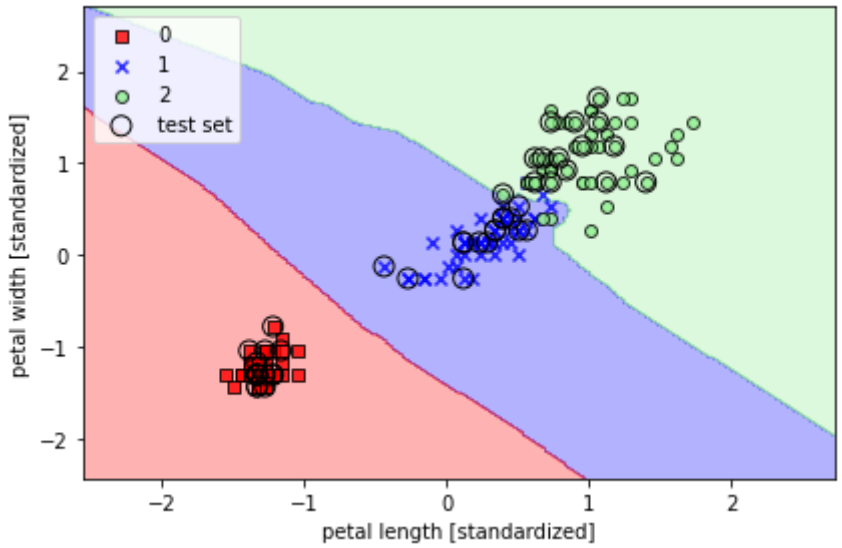
```
from sklearn.metrics import classification_report
import pandas as pd
import pprint

print(classification_report(y_test, y_pred))

print(type(classification_report(y_test, y_pred)))
```

```
              precision    recall  f1-score   support

           0       0.94      1.00      0.97        15
           1       1.00      0.93      0.97        15
           2       1.00      1.00      1.00        15

    accuracy                           0.98        45
   macro avg       0.98      0.98      0.98        45
weighted avg       0.98      0.98      0.98        45

<class 'str'>
```

In [ ]:

```
from sklearn.neighbors import KNeighborsClassifier

knn = KNeighborsClassifier(n_neighbors=5,
                           p=2,
                           metric='minkowski')
knn.fit(X_train_std, y_train)

plot_decision_regions(X_combined_std, y_combined,
                      classifier=knn, test_idx=range(105, 150))

plt.xlabel('petal length [standardized]')
plt.ylabel('petal width [standardized]')
plt.legend(loc='upper left')
plt.tight_layout()
#plt.savefig('images/03_24.png', dpi=300)
plt.show()
```

```
<ipython-input-11-5347af230dfc>:28: UserWarning: You passed a edgecolor/edgecolors
('black') for an unfilled marker ('x').  Matplotlib is ignoring the edgecolor in f
avor of the facecolor.  This behavior may change in the future.
  plt.scatter(x=X[y == cl, 0],
```



In [ ]:

```
from sklearn.metrics import classification_report
import pandas as pd
import pprint

print(classification_report(y_test, y_pred))

print(type(classification_report(y_test, y_pred)))
```

```
              precision    recall  f1-score   support

           0       0.94      1.00      0.97        15
           1       1.00      0.93      0.97        15
           2       1.00      1.00      1.00        15

    accuracy                           0.98        45
   macro avg       0.98      0.98      0.98        45
weighted avg       0.98      0.98      0.98        45

<class 'str'>
```