Задание 1

In [1]:
```
from matplotlib.colors import ListedColormap
from sklearn import cross_validation, datasets, metrics, neighbors
from matplotlib import pyplot
import numpy as np
```

```
/home/nikita/.local/lib/python2.7/site-packages/sklearn/cross_validation.
py:44: DeprecationWarning: This module was deprecated in version 0.18 in
favor of the model_selection module into which all the refactored classes
and functions are moved. Also note that the interface of the new CV itera
tors are different from that of this module. This module will be removed
in 0.20.
  "This module will be removed in 0.20.", DeprecationWarning)
```

Генерируем выборку размера 100 с 2 признаками и 4 классами

In [2]:
```
sample = datasets.make_classification(n_samples=100,
                                      n_features=2,
                                      n_informative=2,
                                      n_redundant=0,
                                      n_classes=4,
                                      n_clusters_per_class=1,
                                      shuffle=True,
                                      random_state=1)
```

Визуализируем разделяющие поверхности для k = 1, 2, 3, 4, 5

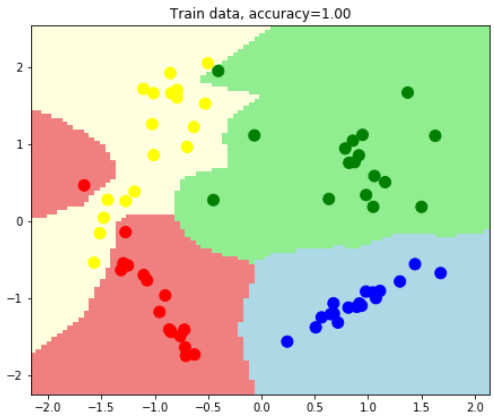
In [3]:
```
colors = ListedColormap(['red', 'blue', 'yellow', 'green'])
light_colors = ListedColormap(['lightcoral', 'lightblue',
                               'lightyellow', 'lightgreen'])

def get_meshgrid(data, step=.05, border=.5,):
    x_min, x_max = data[:, 0].min() - border, data[:, 0].max() + border
    y_min, y_max = data[:, 1].min() - border, data[:, 1].max() + border
    return np.meshgrid(np.arange(x_min, x_max, step),
                       np.arange(y_min, y_max, step))

def plot_decision_surface(estimator, train_data, train_labels,
                          test_data, test_labels,
                          colors = colors, light_colors = light_colors):
    #fit model
    estimator.fit(train_data, train_labels)

    #set figure size
    pyplot.figure(figsize = (16, 6))

    #plot decision surface on the train data
    pyplot.subplot(1,2,1)
    xx, yy = get_meshgrid(train_data)
    mesh_predictions = np.array(estimator.predict(np.c_[xx.ravel(),
                                          yy.ravel()])).reshape(xx.shape)
    pyplot.pcolormesh(xx, yy, mesh_predictions, cmap = light_colors)
    pyplot.scatter(train_data[:, 0], train_data[:, 1], c = train_labels,
                   s = 100, cmap = colors)
    pyplot.title('Train data, accuracy={:.2f}'.format(metrics.accuracy_s
core(
        train_labels, estimator.predict(train_data))))

    #plot decision surface on the test data
    pyplot.subplot(1,2,2)
    pyplot.pcolormesh(xx, yy, mesh_predictions, cmap = light_colors)
    pyplot.scatter(test_data[:, 0], test_data[:, 1], c = test_labels,
                   s = 100, cmap = colors)
    pyplot.title('Test data, accuracy={:.2f}'.format(metrics.accuracy_sc
ore(
        test_labels,estimator.predict(test_data))))
    pyplot.show()
```

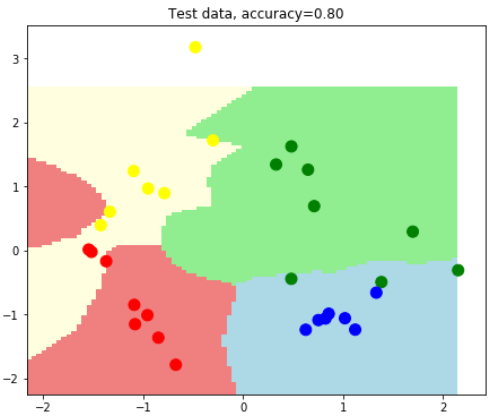
Разделим данные: обучающая выборка составляет 0.3 от всей

In [4]:
```
train_data, test_data, train_labels, test_labels = cross_validation.trai
n_test_split(
                                        sample[0], sample[1],
                                        test_size = 0.3, random_state =
1)
```

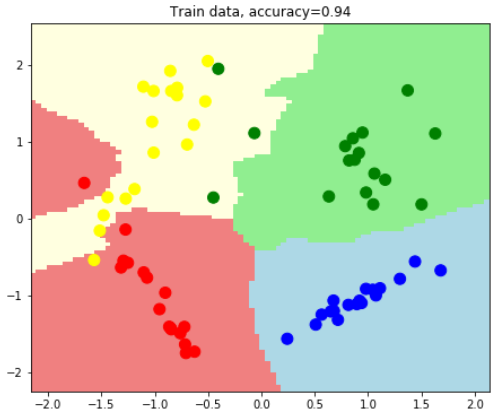
In [5]:
```
for i in range(1, 6):
    print("AMOUNT OF NEIGHBORS = " + str(i))
    estimator = neighbors.KNeighborsClassifier(n_neighbors=i)
    plot_decision_surface(estimator, train_data, train_labels,
                          test_data, test_labels)
```

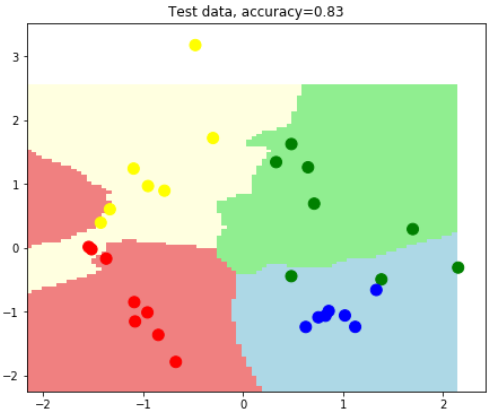
AMOUNT OF NEIGHBORS = 1



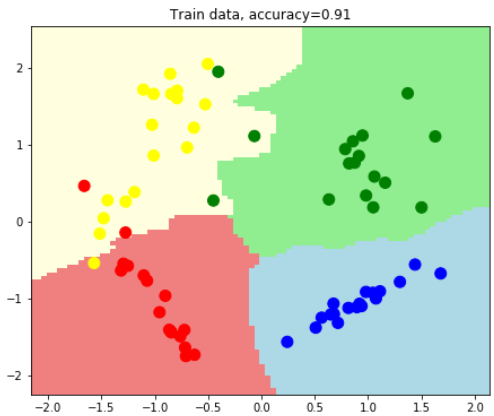


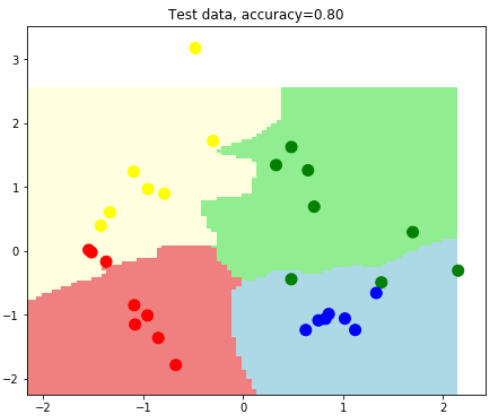
AMOUNT OF NEIGHBORS = 2



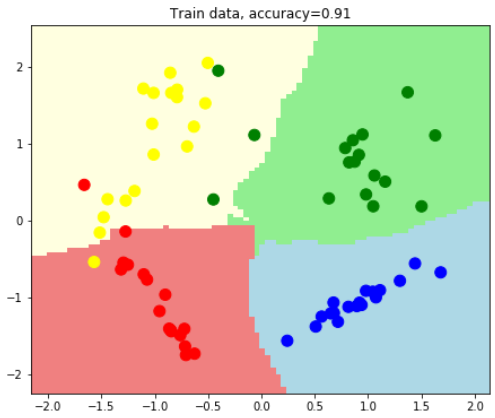


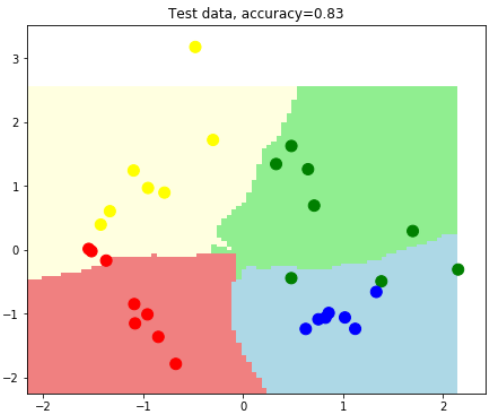
AMOUNT OF NEIGHBORS = 3



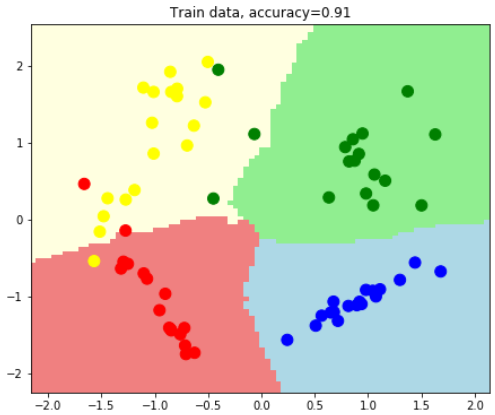


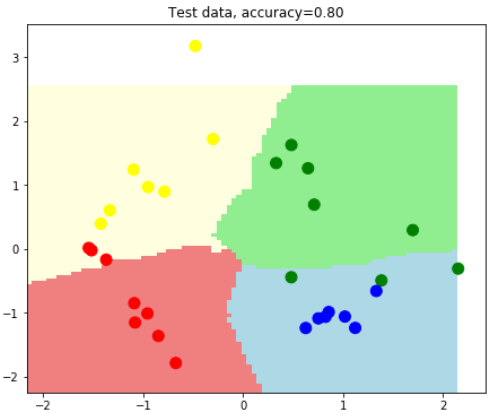
AMOUNT OF NEIGHBORS = 4






```
AMOUNT OF NEIGHBORS = 5
```

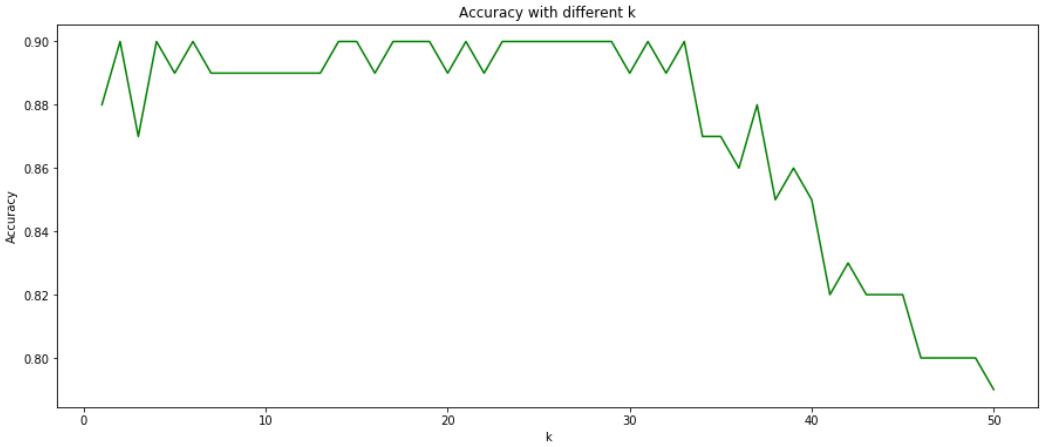




Попробуем подобрать оптимальное k с помощью 5-fold cross-validation

In [6]:
```
from sklearn.cross_validation import cross_val_score

accuracy = []
k = range(1, 51)

for i in range(1, 51):
    knn = neighbors.KNeighborsClassifier(n_neighbors=i)
    scores = cross_val_score(knn, sample[0], sample[1],
                             cv=5, scoring='accuracy')
    accuracy.append(scores.mean())
```

In [8]:
```
pyplot.figure(figsize=(15, 6))
pyplot.plot(k, accuracy, c='g')
pyplot.title("Accuracy with different k")
pyplot.xlabel('k')
pyplot.ylabel('Accuracy')
pyplot.show()
```



In [27]:
```
accuracy[5]
```

Out[27]:
```
0.90000000000000002
```