

**Exercise 1:**

Choose some of the classifiers already introduced in the lecture and visualize their decision boundaries for relevant hyperparameters. Use `mlbench::mlbench.spirals` to generate data and use `plot.learner_prediction` for visualization. To refresh your knowledge about `mlr3` you can take a look at <https://mlr3book.ml-org.com/basics.html>.

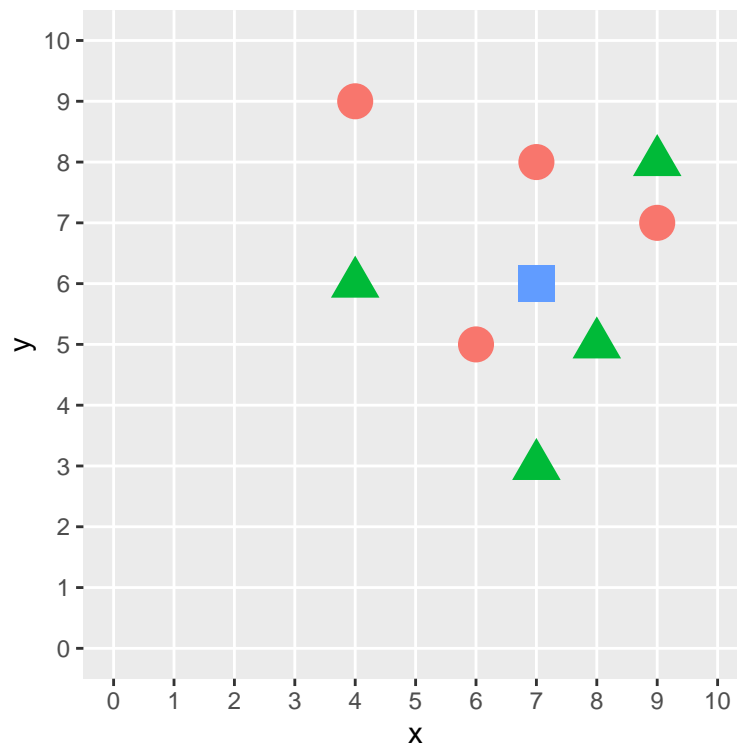
**Exercise 2:**

Let the 2D feature vectors in the following figure be with two different class labels (triangles and circles). Classify the point (7,6) - represented by a square in the picture - with a k-nearest neighbor classifier. Distance function should be the  $L_1$  norm (Manhattan distance):

$$d_{\text{manhattan}}(x, \tilde{x}) = \sum_{j=1}^p |x_j - \tilde{x}_j|$$

As a decision rule, use the unweighted number of the individual classes in the k-next Neighbor Quantity, i. e. the point is assigned to the class that represents most k-nearest neighbors.

- a)  $k = 3$
- b)  $k = 5$
- c)  $k = 7$



**Exercise 3:**

You are given the following table with the target variable **Banana**:

ID	Color	Form	Origin	Banana ?
1	yellow	oblong	imported	yes
2	yellow	round	domestic	no
3	yellow	oblong	imported	no
4	brown	oblong	imported	yes
5	brown	round	domestic	no
6	green	round	imported	yes
7	green	oblong	domestic	no
8	red	round	imported	no

- a) We want to use a naive Bayes classifier to predict whether a new fruit is a Banana or not. Calculate the posterior probability  $\pi(x)$  for a new observation (yellow, round, imported). How would you classify the object?
- b) Assume you have an additional feature "Length", which measures the length in cm. Describe in 1-2 sentences how you would handle this numeric feature with Naive Bayes.