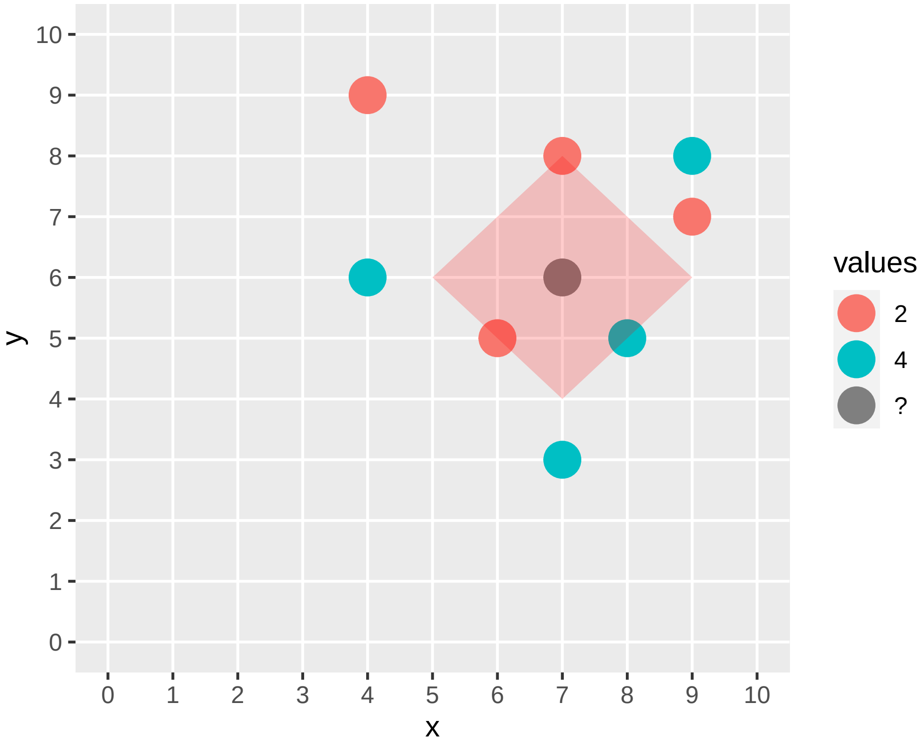
Solution 1:

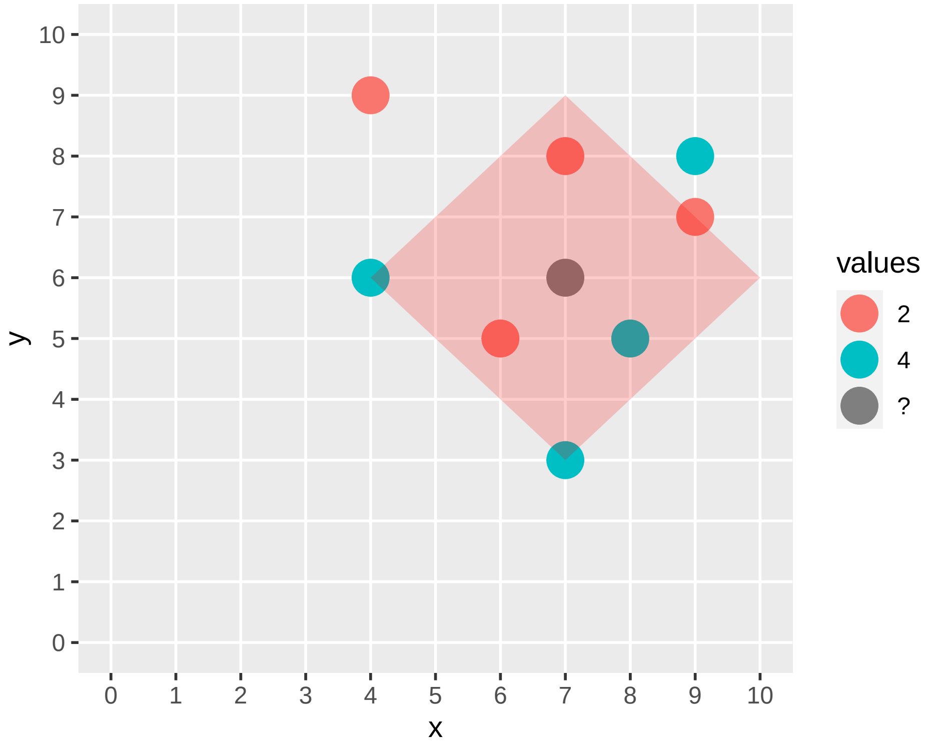
a) $k = 3$

$$\hat{y} = \frac{2+2+4}{3} = \frac{8}{3} \approx 2.67$$
$$\hat{y}_{\text{weighted}} = \frac{\frac{1}{2}\cdot 2 + \frac{1}{2}\cdot 2 + \frac{1}{2}\cdot 4}{\frac{3}{2}} = \frac{8}{3} \approx 2.67$$



b) $k = 5$

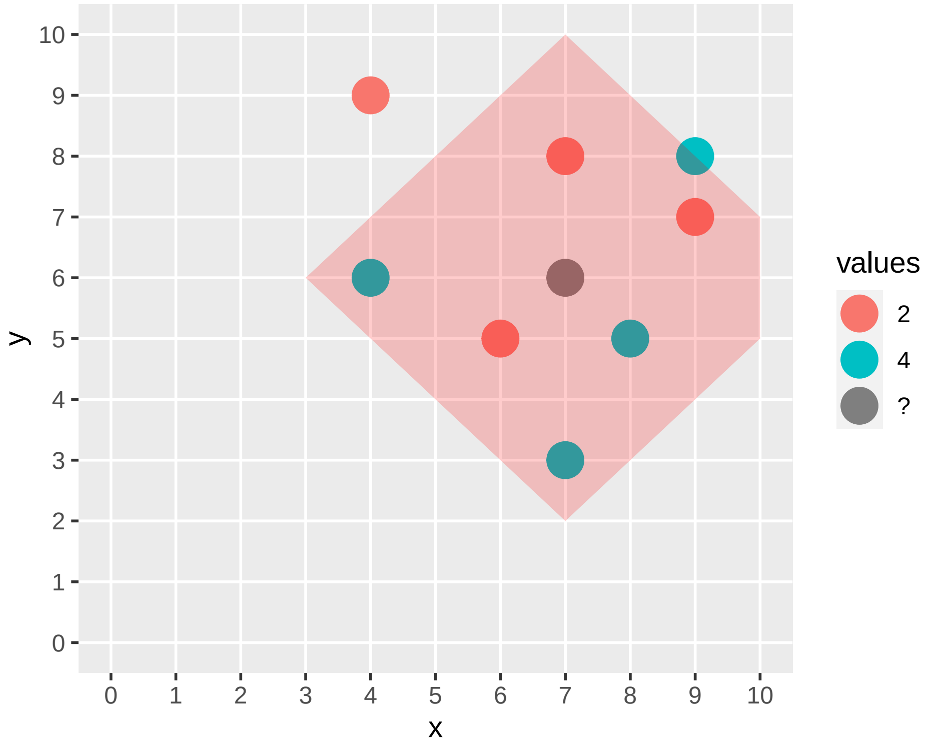
$$\hat{y} = \frac{2+2+2+4+4+4}{6} = 3$$
$$\hat{y}_{\text{weighted}} = \frac{\frac{1}{2}\cdot 2 + \frac{1}{2}\cdot 2 + \frac{1}{3}\cdot 2 + \frac{1}{2}\cdot 4 + \frac{1}{3}\cdot 4 + \frac{1}{3}\cdot 4}{\frac{5}{2}} = \frac{44}{15} \approx 2.93$$



c) $k = 7$

$$\hat{y} = \frac{2+2+2+4+4+4+4}{7} = \frac{22}{7} \approx 3.14$$

$$\hat{y}_{\text{weighted}} = \frac{\frac{1}{2}\cdot 2 + \frac{1}{2}\cdot 2 + \frac{1}{3}\cdot 2 + \frac{1}{2}\cdot 4 + \frac{1}{3}\cdot 4 + \frac{1}{3}\cdot 4 + \frac{1}{4}\cdot 4}{\frac{11}{4}} = \frac{100}{33} \approx 3.03$$



Solution 2:

a) Learning consists of *representation* (hypothesis space), *evaluation* (risk) and *optimization*.
A learner in mlr3 can be thought of as the implementation of these components, since

- a representation of the associated model learnt from the data by using the implemented optimization is stored in such a learner object,
- its performance measures can be accessed afterwards.

b)

```r
library(mlr3)
library(mlr3learners)

# show all available learners
mlr_learners$keys()

##  [1] "classif.cv_glmnet"   "classif.debug"       "classif.featureless"
##  [4] "classif.glmnet"      "classif.kknn"        "classif.lda"
##  [7] "classif.log_reg"     "classif.multinom"    "classif.naive_bayes"
## [10] "classif.qda"         "classif.ranger"      "classif.rpart"
## [13] "classif.svm"         "classif.xgboost"     "regr.cv_glmnet"
## [16] "regr.featureless"    "regr.glmnet"         "regr.kknn"
## [19] "regr.km"             "regr.lm"             "regr.ranger"
## [22] "regr.rpart"          "regr.svm"            "regr.xgboost"
## [25] "surv.cv_glmnet"      "surv.glmnet"         "surv.ranger"
## [28] "surv.xgboost"

# see settings for a specific learner, e.g., for a regression tree
rpart_learner <- lrn("regr.rpart")
print(rpart_learner)

## <LearnerRegrRpart:regr.rpart>
## * Model: -
## * Parameters: xval=0
## * Packages: rpart
## * Predict Type: response
## * Feature types: logical, integer, numeric, factor, ordered
## * Properties: importance, missings, selected_features, weights
```

Solution 3:
See R code **lm_knn_l_1a.R**