Exercise 1:

(a) Suppose that we want to compare four different models:

Model	Needs Tuning
Logit Model (lm)	No
CART (rpart)	Yes
k-NN (kknn)	Yes
LDA (lda)	No

To be able to compare the different models we use a 10-fold cross-validation as outer resampling strategy. Within the tuning of CART and k-NN we use a 5-fold cross-validation in combination with random search by drawing 200 hyperparameter configurations for each model. Our measure of interest is the AUC.

(i) To conduct the final benchmark to compare the models, how many models need to be fitted in total?

(ii) Giving the following benchmark result, which model is best? Explain your decision in one sentence.

```
## Error in library(ggplot2):  there is no package called 'ggplot2'
## Error in ggplot(data = df_bm, aes(x = model, y = score, fill = Measure)):  could
not find function "ggplot"
```

(b) Explain in two sentences what is meant by the *bias - variance trade-off in resampling*.

(c) Are the following statements true or not, explain your answer in one sentence.

(i) The bias of the generalization error for 3-fold cross-validation is higher than for 10-fold cross-validation.

(ii) Every outer loss can also be used as inner loss. Assume any gradient descent based model.

Exercise 2:

Make yourself familiar with the Titanic kaggle challenge (`https://www.kaggle.com/c/titanic`).

Based on everything you learned in this course, do your best to get a good performance in the Titanic survival challenge.

a) Try out different classification models you learned during the course (or maybe even something new?)

b) Improve the prediction by creating new features (feature engineering)

c) Tune your parameters (see: `https://mlr3book.mlr-org.com/tuning.html`)

d) How big are the differences between your own performance estimate and the estimate of the public leaderboard?

Hint: Use the `titanic` package to get directly access to the data. Use `titanic::titanic_train` for training and `titanic::titanic_test` for your final prediction.