lab_7

Lindsey Greenhill

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Question 1

```
## [1] "In generation 1, parent_rank = 57.9, child_rank = 53.6329"
## [1] "In generation 2, parent_rank = 53.6329, child_rank = 52.1351479"
## [1] "In generation 3, parent_rank = 52.1351479, child_rank = 51.6094369129"
## [1] "In generation 4, parent_rank = 51.6094369129, child_rank = 51.4249123564279"
## [1] "In generation 5, parent_rank = 51.4249123564279, child_rank = 51.3601442371062"
## [1] "In generation 6, parent_rank = 51.3601442371062, child_rank = 51.3374106272243"
## [1] "In generation 7, parent_rank = 51.3374106272243, child_rank = 51.3294311301557"

## [1] "In generation 1, parent_rank = 32.7, child_rank = 44.7877"
## [1] "In generation 2, parent_rank = 44.7877, child_rank = 49.0304827"
## [1] "In generation 3, parent_rank = 49.0304827, child_rank = 50.5196994277"
## [1] "In generation 4, parent_rank = 50.5196994277, child_rank = 51.0424144991227"
## [1] "In generation 5, parent_rank = 51.0424144991227, child_rank = 51.2258874891921"
## [1] "In generation 6, parent_rank = 51.2258874891921, child_rank = 51.2902865087064"
## [1] "In generation 7, parent_rank = 51.2902865087064, child_rank = 51.312890564556"

## [1] "In generation 1, parent_rank = 32.7, child_rank = 34.556"
## [1] "In generation 2, parent_rank = 34.556, child_rank = 35.07568"
## [1] "In generation 3, parent_rank = 35.07568, child_rank = 35.2211904"
## [1] "In generation 4, parent_rank = 35.2211904, child_rank = 35.261933312"
## [1] "In generation 5, parent_rank = 35.261933312, child_rank = 35.27334132736"
## [1] "In generation 6, parent_rank = 35.27334132736, child_rank = 35.2765355716608"
## [1] "In generation 7, parent_rank = 35.2765355716608, child_rank = 35.277429960065"

## [1] "In generation 1, parent_rank = 36.17, child_rank = 45.5442"
## [1] "In generation 2, parent_rank = 45.5442, child_rank = 47.981492"
## [1] "In generation 3, parent_rank = 47.981492, child_rank = 48.61518792"
## [1] "In generation 4, parent_rank = 48.61518792, child_rank = 48.7799488592"
## [1] "In generation 5, parent_rank = 48.7799488592, child_rank = 48.822786703392"
## [1] "In generation 6, parent_rank = 48.822786703392, child_rank = 48.8339245428819"
## [1] "In generation 7, parent_rank = 48.8339245428819, child_rank = 48.8368203811493"
```

The steady state prediction for Hispanic children is 48.8

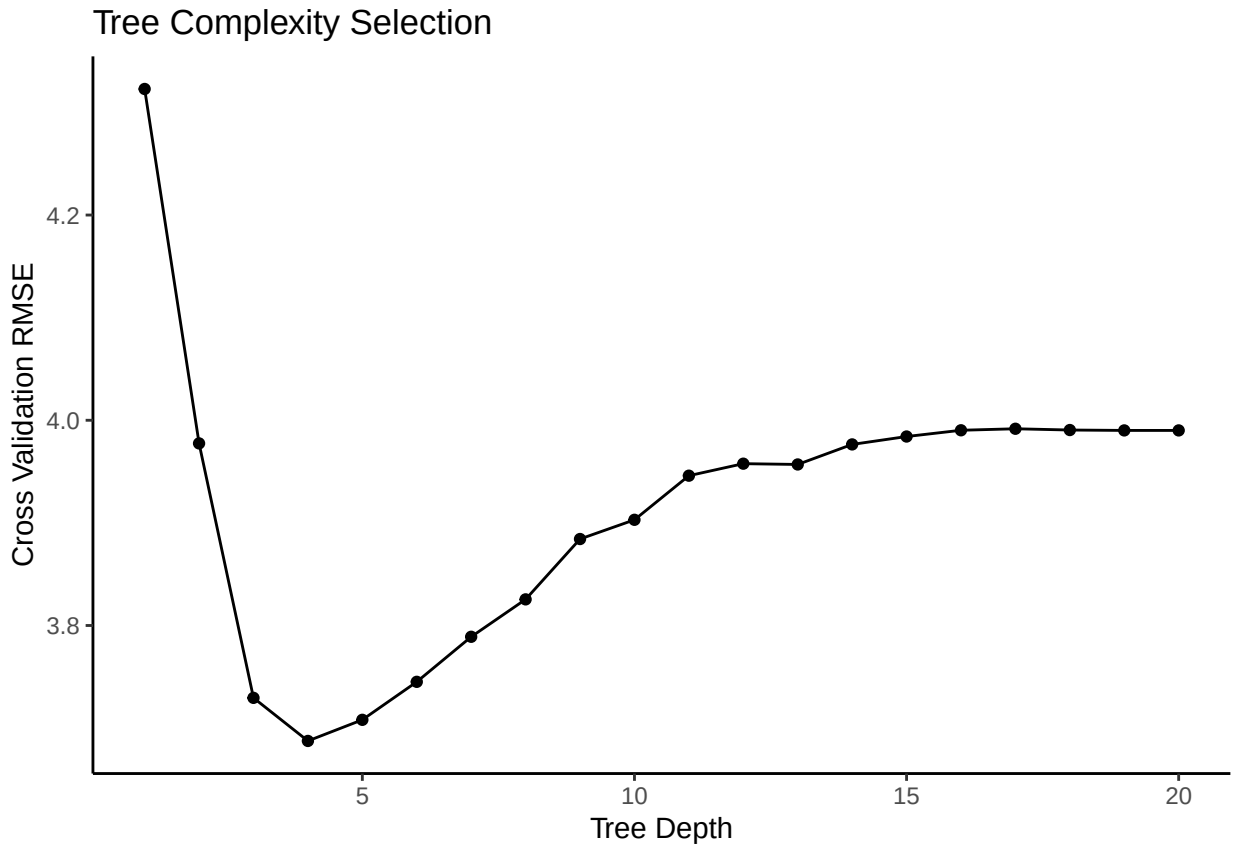
Question 2

Cross Validation helps avoid the overfit problem by allowing you to test different levels of tree complexities on data you didn't use to create the model and allows you to systematically select the level of complexity that minimizes out of sample prediction error.

Question 3

Part a

I am using P_26 – fraction of residents with a college degree or more in 2000 and P_55 (physically unhealthy days per month)

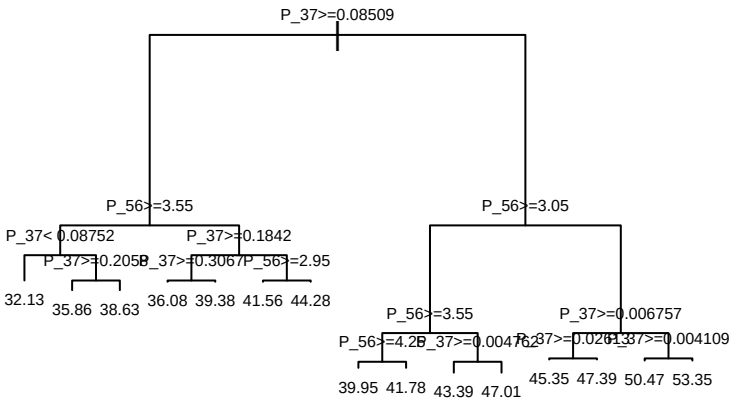


Part b

Using the graph above, a tree depth of 4 is optimal

Part c

P_37 (share black in 2000) and P_56 (mentally unhealthy days per month) are being used in the first few splits in the tree



Part d

Question 4

Random forests improve upon decision using bagging because it allows you to take the average of many different decision trees to find the optimal one and eliminates the "noise" of the individual models. Random forests use input randomization to decrease the correlation between the predictions of the trees.

Question 5

```
##
## Call:
##  randomForest(formula = kfr_pooled_pooled_p25 ~ P_26 + P_55, data = training,      ntree = 1000, mtry
##                Type of random forest: regression
##                      Number of trees: 1000
## No. of variables tried at each split: 2
##
##           Mean of squared residuals: 15.54337
##                     % Var explained: 41.82
```

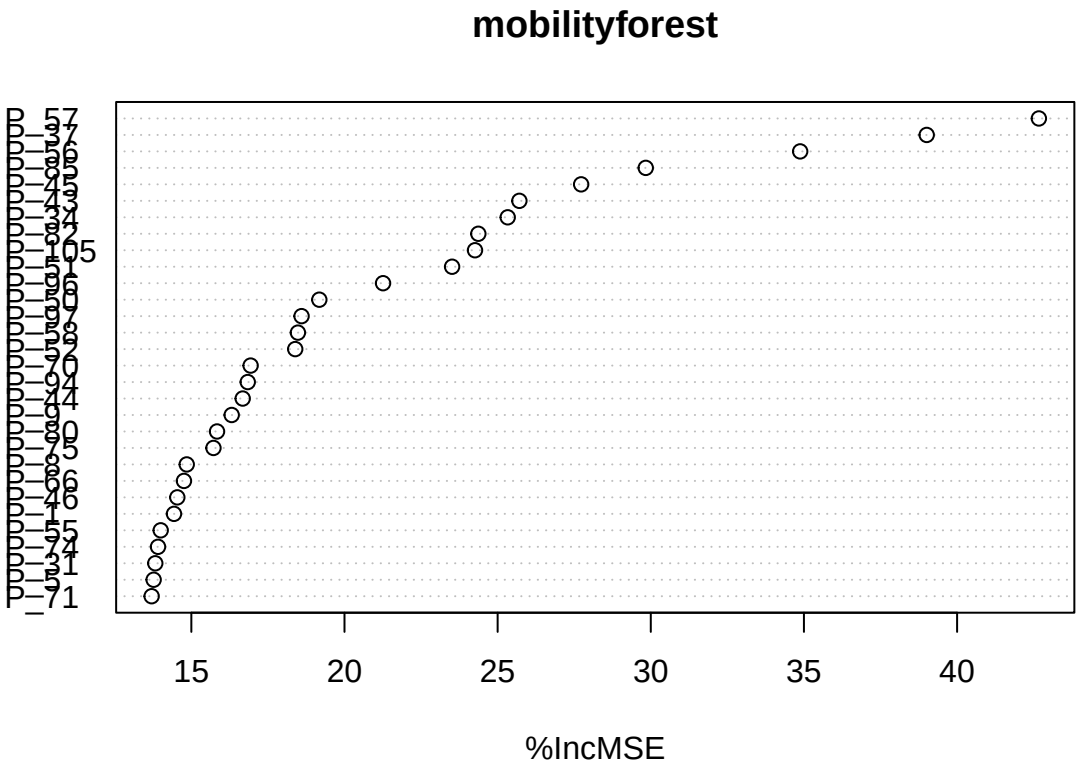
Question 6

```
##
```

```
## Call:
##  randomForest(formula = kfr_pooled_pooled_p25 ~ ., data = training,      ntree = 1000, mtry = 121, i
##                Type of random forest: regression
##                      Number of trees: 1000
## No. of variables tried at each split: 121
##
##           Mean of squared residuals: 4.801709
##                     % Var explained: 82.03
```

Question 7

Looking at the graph below, the 5 most important predictors appear to be P_37(share black in 2000), P_57 (% of adults that report fair or poor health), P_56 (mentally unhealthy days per month), P_45 (share of single headed households with children 2000), and P_85 (% total: roman catholic)



Question 8

The large random forest does best, followed by the small random foreest and the individual tree, respectively

```
##       RMSPE   method
## 1 2.9015320     Tree
## 2 2.0660741 Small RF
## 3 0.8626389 Large RF
```

Question 9

The large random forest does best, followed by the individual tree and small random forest, respectively.

```
##   OOS_RMSPE   method
## 1  3.036052     Tree
## 2  3.860971 Small RF
## 3  2.254114 Large RF
```