Exercise 1

This first example gives you a short introduction to the back-door criterion and how to use it in R We begin by loading necessary packages - if you don't have them, install them now.

```r
library(ggdag)
library(dagitty)
```

We will define a DAG using the dagitty command. The reason why we need a long statement in quotation marks is that the dagitty command actually takes a dag statement from the dagitty website (http://www.dagitty.net). For this example, I created the graph in dagitty, and then I just copied and pasted the model code into Rstudio. I did not type out this whole graph below. If you had to, it works as follows: - every variable is on a single line - the pos argument is optional, but allows you to control the position of each node - arrows between variables are simply done by typing two variables and putting an arrow between them

```r
dag1 <- dagitty('dag {
            Coach [pos="-4.392,-7.906"]
            ConnectiveTissueDisorder [pos="3.494,-5.099"]
            ContactSport [pos="-1.157,2.548"]
            FitnessLevel [pos="-1.489,-4.530"]
            Genetics [pos="2.022,-7.906"]
            Injury [outcome,pos="4.969,8.605"]
            IntraGameProprioception [pos="-1.196,8.487"]
            NeuromuscularFatigue [pos="1.501,-1.235"]
            PreGameProprioception [pos="-3.638,-1.235"]
            PreviousInjury [pos="-4.293,4.175"]
            TeamMotivation [pos="-7.175,-0.950"]
            TissueWeakness [pos="4.236,1.857"]
            WarmUpExercises [exposure,pos="-7.000,8.650"]
            Coach -> FitnessLevel
            Coach -> TeamMotivation
            ConnectiveTissueDisorder -> NeuromuscularFatigue
            ConnectiveTissueDisorder -> TissueWeakness
            ContactSport -> IntraGameProprioception
            ContactSport -> PreviousInjury
            FitnessLevel -> NeuromuscularFatigue
            FitnessLevel -> PreGameProprioception
            Genetics -> ConnectiveTissueDisorder
            Genetics -> FitnessLevel
            Genetics -> NeuromuscularFatigue
            IntraGameProprioception -> Injury
            NeuromuscularFatigue -> Injury
            NeuromuscularFatigue -> IntraGameProprioception
            PreGameProprioception -> WarmUpExercises
            TeamMotivation -> PreviousInjury
            TeamMotivation -> WarmUpExercises
            TissueWeakness -> Injury
            WarmUpExercises -> IntraGameProprioception
            }')
```

The ggdag package allows plotting of the model, and also of adjustment sets that are identified using the back-door criterion. Because the model is large, and there are many sets, the adjustment set display is not very helpful in this case.

```
ggdag(dag1,text_size = 3,text_col = "orange")
```

Warning: package 'bindrcpp' was built under R version 3.4.4
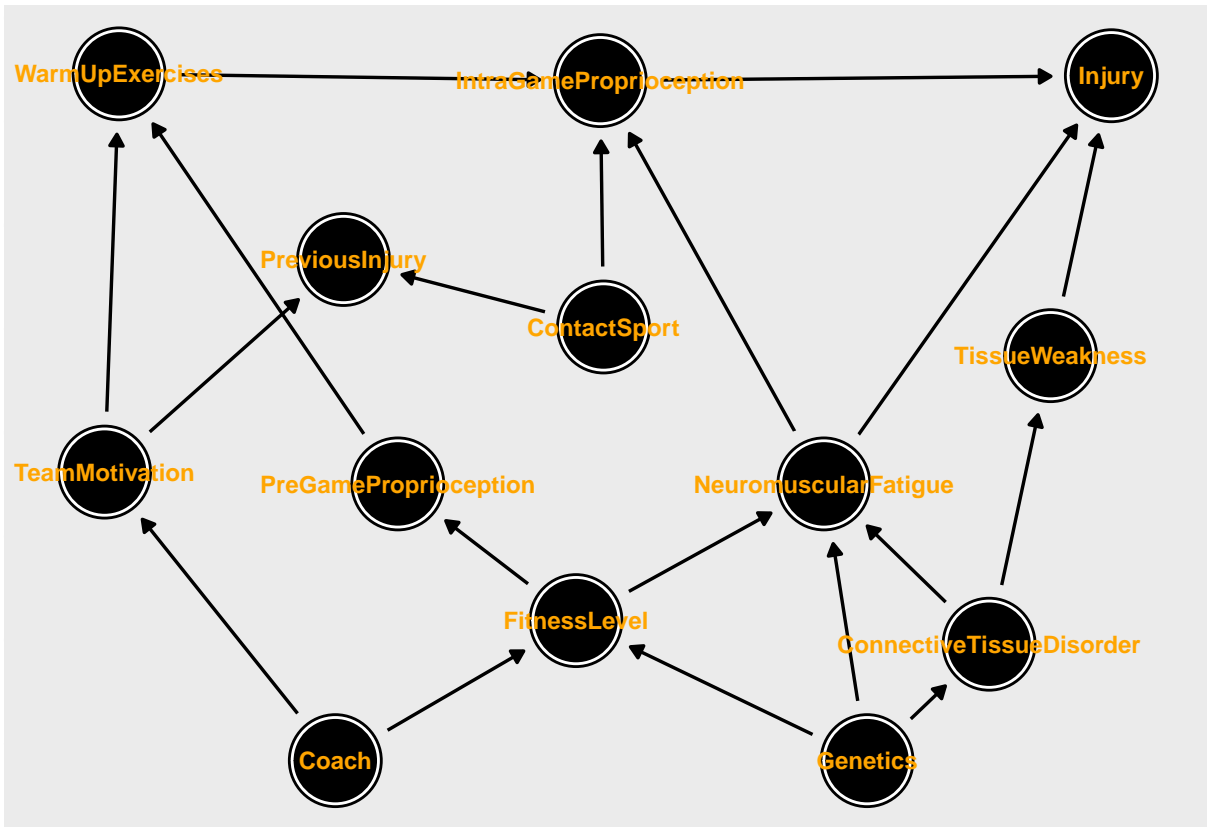

```
ggdag_adjustment_set(dag1, text_size = 3, text_col = "black")
```
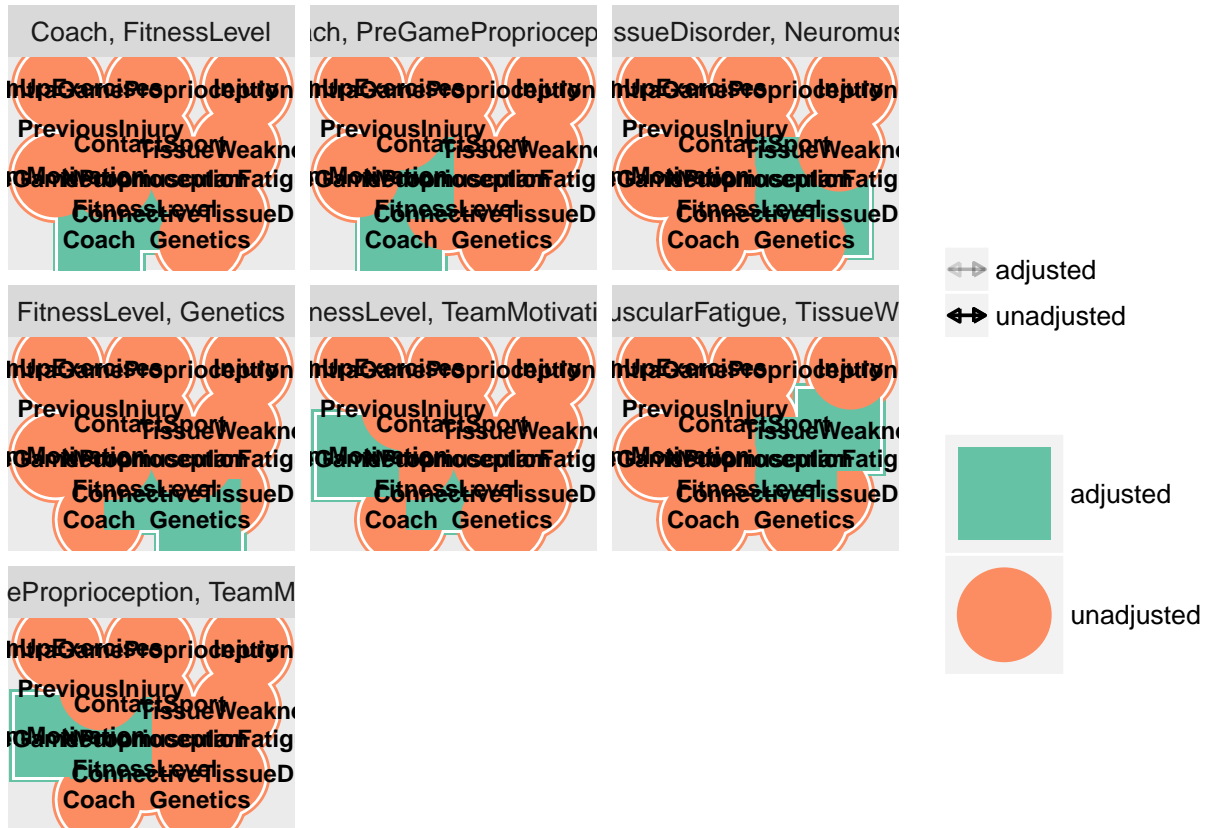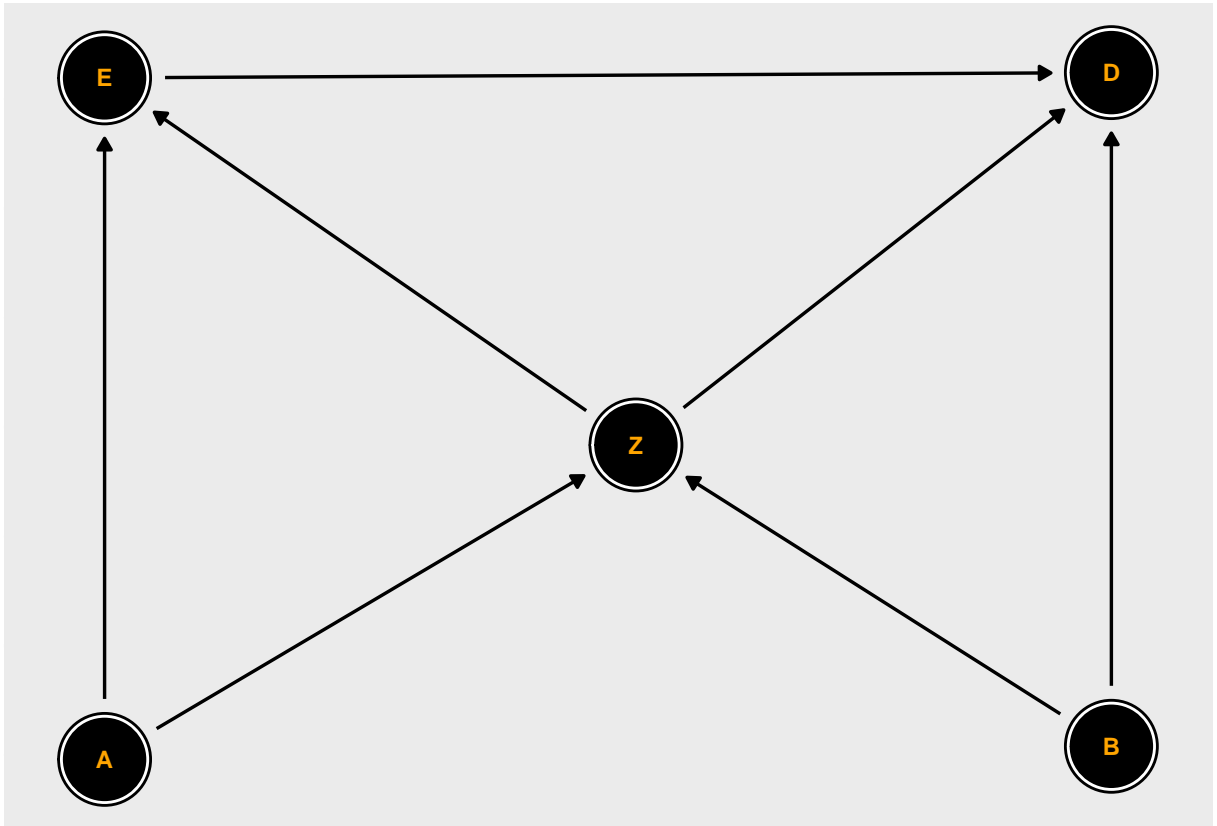
The adjustmentSets command, simply lists the adjustment sets.

```r
adjustmentSets(dag1)
```

```
## { NeuromuscularFatigue, TissueWeakness }
## { ConnectiveTissueDisorder, NeuromuscularFatigue }
## { FitnessLevel, Genetics }
## { Coach, FitnessLevel }
## { FitnessLevel, TeamMotivation }
## { Coach, PreGameProprioception }
## { PreGameProprioception, TeamMotivation }
```

Exercise:

1.) Using the daggity language, create the following DAG in R.

2.) Using the ggdag package, plot the DAG that you just created.

3.) Use the back-door criterion by hand to find an adjustment set for the causal effect of E on D.

4.) Confirm this set by using the adjustmentSets command.