Almond Yield: Function

Load Libraries

```r
library(dplyr)
library(tidyr)
library(ggplot2)
library(kableExtra)
library(knitr)
```

Load Data

```r
almonds <- read.table(here::here("Assignments", "assignment3", "clim.txt"),
           header = TRUE)

source(here::here("Assignments", "assignment3", "almond_function.R"))
```

Monthly Averages

Monthly Averages (per year) *aggregated to state scale / crop area* (idk how to scape to state size)

```r
almond_subset <- almonds %>%
  group_by(month, year) %>%
  summarize(tmin = mean(tmin_c, na.rm = TRUE),
            tmax = mean(tmax_c, na.rm = TRUE),
            precip = sum(precip,  na.rm = TRUE)) %>%
  ungroup()
```

INPUT dataframes

```
# Pulling out just Feb tmin
tmin_feb <- almond_subset %>%
  filter(month == 2) %>%
  select(tmin)

# Pullung out just January precipitation
precip_jan <- almond_subset %>%
  filter(month == 1) %>%
  select(precip)

# Creating df of years
year <- almond_subset %>%
  filter(month == 1) %>%
  select(year)
```

Apply Functions to tmin_feb and precip_jan

Almond Equation

$$Y = -0.015T_{nFeb} - 0.0046T_{nFeb}^2 - 0.07P_{Jan} + 0.0043P_{Jan}^2 + 0.28$$

```
# Use function
almond_anomaly <- almond_function(tmin_feb = tmin_feb,
                                   precip_jan = precip_jan,
                                   year = year,
                                   graph = TRUE)

almond_anomaly
```

```
$data
   year yield_anomaly
1  1989    -0.3552237
2  1990     9.2906757
3  1991    68.9130633
4  1992    15.4280698
5  1993    20.2083803
6  1994     2.4820009
```

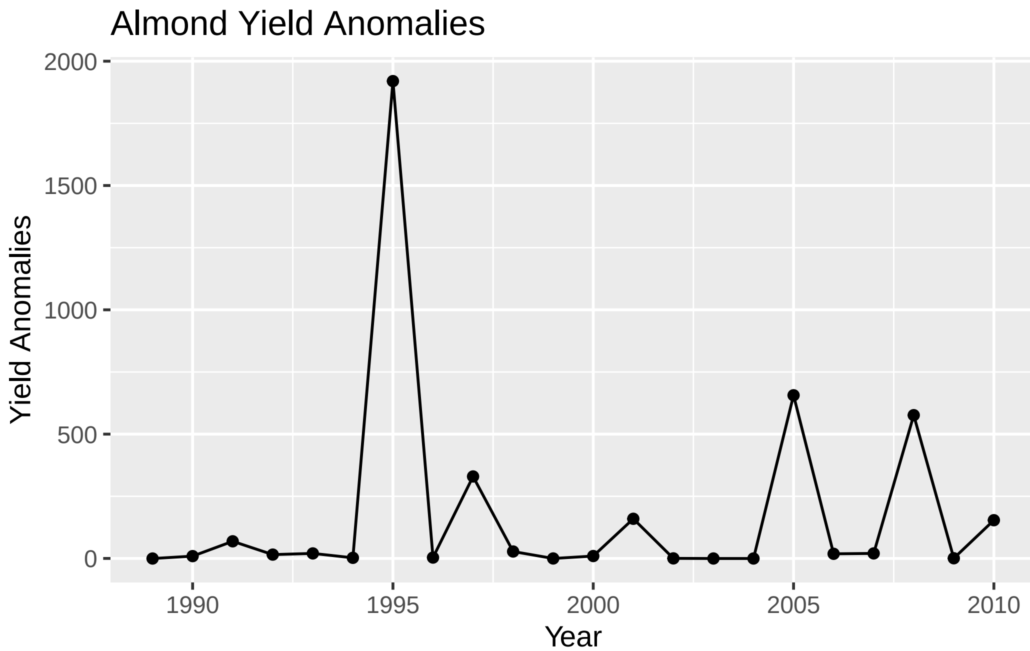
```
7  1995  1919.9811511
8  1996     3.5818399
9  1997   329.6938750
10 1998    27.8636956
11 1999    -0.1436364
12 2000     9.5999883
13 2001   159.5119587
14 2002     0.2450914
15 2003    -0.2585997
16 2004    -0.2367722
17 2005   656.3724121
18 2006    18.6324135
19 2007    20.2007396
20 2008   576.2821943
21 2009     0.7367438
22 2010   153.7655092

$table


Table: Almond Yield Characteristics

|     max|   min|   mean|
|-------:|-----:|------:|
| 1919.98| -0.36| 181.45|

$plot
```



Wine Grapes Equation

$$Y = 2.65T_{n4} - 0.17T_{n4}^2 + 4.78P_6 - 4.93P_6^2 - 2.24P_{-9} + 1.54P_{-9}^2 - 10.50$$

Assignment Info

Lobell et al., 2006 used data to build models of tree crop yield for California that captured how climate variation (place and time) might influence yield

- Yield anomaly
- Climate variables

Assumptions…as you work think about what these are…

Assignment

For this assignment you will work in *pairs*

Your goal is to implement a simple model of almond yield anomaly response to climate

- Inputs: daily times series of minimum, maximum daily temperatures and precipitation
- Outputs: maximum, minimum and mean yield anomoly for a input time series

The Lobell et al. 2006 paper will be the source for the transfer function that you will use in your model; specifically look at the equations in table 2.

What you will do - Model Set Up

1. Draw diagram to represent your model - how it will translate inputs to outputs, with parameters that shape the relationship between inputs an outputs - on your diagram list what your inputs, parameters and outputs are with units
2. Implement your diagram as an R function

Here are some ideas to think though. The climate data is going to need to be processed (e.g note that the model uses climate data from a particular month - you have ALL of the climate as daily data). Here are two possible model outlines to follow

Almond_model <- function(clim_var1, clim_var2, parameters){……}

Almond_model <- function(clim, parameters){……}

The first example is where the climate variables are separately input into the function - climate data is processed beforehand as part of model set up

The second is where a climate data frame is the input to the function and you extract the useful data from it as part of the model.

You can pick which option you prefer (or try both) If you want a coding challenge, you could create a model that works for any crop

Run the model

3. Run your model for the **clim.txt** data that is posted on Canvas,

clim.txt has the following columns

these 4 columns tell you when climate observations were made

- *day*
- *month*
- *year*
- *wy* (water year)

the next 3 columns are the climate observations

- maximum (*tmax_c*) daily temperature
- minimum (*tmin_c*) daily temperature
- precipitation (*precip*) on that day in mm

check your work

I will tell you that

- the maximum almond yield anomaly should be approximately 1920 ton/acre
- the lowest almond yield anomaly should be approximately -0.027 ton/acre
- the mean almond yield anomaly should be approximately 182 ton/acre

Notes

- There are always multiple ways to code something in R;
- Remember that we want to strive for our code being as simple and streamline as possible.
- Style counts.
  - Make sure you choose meaningful variable names and add comments.
  - Include comments at the top of the function to tell the user what the inputs/outputs are and their units and format.

What to hand in on Canvas

Two separate files (or a link to a repository with these files)

1. a R file that has your function definition
2. a pdf that includes your conceptual model (embed as picture), your workflow for running the model and shows how you applied the function to the test climate data (*clim.txt*)

Due January 22 8am50 # Grading Rubric

Conceptual model (20 pts)

- a clear diagram that corresponds with your R function (10 pts)
- inputs and output and parameters shown on the diagram (10 pts)

R Implementation (30 pts)

- correct function implementation (*.R file) (10 pts)
- application of the function to **clim.txt** (in Rmarkdown file) (10 pts)
- coding practices (clear documentation, informative variables names) (10 pts)