MATH 5075 R Project 2

Your Name Here

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Remember: I expect to see commentary either in the text, in the code with comments created using `#`*, or (preferably) both!* ***Failing to do so may result in lost points!***

Because randomization is used in this assignment, I set the seed here, in addition to beginning each code block. ***Do not change the seed!***

```
set.seed(10182016)
```

Problem 1

Consider the following AR(p) process (with w_t being i.i.d. standard Normal random variables):

$$x_t = \frac{1}{2}x_{t-1} - \frac{1}{3}x_{t-2} + w_t$$

1. *Simulate this process in R using the function* `arima.sim()` *for $T = 500$ observations, burning in for 1000 observations.*

```
# Your code here
```

2. *Compute and plot the sample autocorrelation function for the simulated process using* `acf()`*. Compare the sample autocorrelation function to the theoretical autocorrelation function, which you can compute and plot using* `ARMAacf()`*.*

```
# Your code here
```

3. *The above process is a stationary process (why?), which implies that the process can be written in the form:*

$$x_t = \sum_{l=0}^{\infty} \psi_l w_{t-l}$$

Use the function `ARMAtoMA()` *to compute the first 25 ψ-weights for this process (the theoretical ψ-weights, not the empirical), and plot them.*

```
# Your code here
```

Problem 2

1. *Simulate $T = 100$ observations from an AR(1) process using* `arima.sim()`*, burning in for 500 observations, and plot the resulting process. Repeat for each of the following AR coefficients, and comment on what you see: $\phi \in \{-0.1, 0, 0.01, 0.1, 0.5, 0.7, 1, 1.2\}$*

```
# Your code here
```

2. *Simulate $T = 100$ observations from an AR(2) process using* `arima.sim()`*, burning in for 500 observations, and plot the resulting process. Repeat for each of the following combinations of AR coefficients, and comment on what you see: $(\phi_1, \phi_2) \in \{(-0.4, 0.4), (0, 0.4), (.5, .5)\}$*

```
# Your code here
```

Problem 3

1. *Consider the data set* `globtempl` *(**astsa**), which contains measurements of annual land temperatures from 1880 to 2015. Plot the data and estimate the sample autocorrelation function. Does this appear to be a stationary series? Does the ACF appear to be one that could plausibly come from an AR(p) model? Do you believe that this series (without any modification) can be modeled by an AR(p) model?*

```
# install.packages('astsa')
library(astsa)
```

```
## Warning: package 'astsa' was built under R version 3.2.5
```

```
# Your code here
```

2. *Use* `diff()` *to compute the first differences of the* `globtempl` *data set, and repeat the analysis done in part 1 on the differences.*

```
# Your code here
```