Final Exam Instructions

- The exam and dataset will be made available to you at 9:00am on Thursday 12/18.
- The exam is due electronically or in person at 12:00 midnight on Friday 12/19. LATE EXAMS WILL BE PENALIZED 10% FOR EACH HOUR LATE!
- You should format your exam in report form. Type your exam using LaTeX or Word or other professional software. Separate your report into sections, as appropriate.
- Include any relevant figures. Label all figures, and clearly describe the importance of the figure in the text of your report. Do not include any figures in your report that are not described in the text of your report.
- You may NOT consult with any other person in any way, electronically or in person, about this exam.
- Clearly cite any sources used in your analysis.
- Include complete R code to replicate your entire analysis at the end of your report. This code should have enough comments that the grader can find important sections of your code to verify your statements as needed.
- For each problem, conduct an appropriate exploratory data analysis, perform residual analyses, and any other appropriate analysis. Comment on the appropriateness of any modeling assumptions made.
- Clearly specify any statistical models used and the methods used to estimate model parameters.

Honor Code Statement

Sign the following and turn it in as the cover sheet of your exam.

I affirm that the report I have submitted is my work, and my work only, and that I have neither given nor received any help or information from any other person. I have cited any written sources I used to complete my report. I recognize that giving or receiving any help on this exam constitutes cheating and will result in my receiving a zero grade on this exam, as well as potentially other consequences under PSU's Policy on Academic Integrity.

Signature: _____ Date: _____

The "dove.Rdata" file contains information about mourning dove recruitment with the following columns:

- y - the number of juvenile doves found at the site
- N - the total number of doves (adults and juveniles) found at the site
- P - the total precipitation (in mm) from April to August in the sampling year
- eT - the average minimum temperature in April and May for the sampling year
- lT - the average maximum temperature from June to August for the sampling year
- $P.clim$ - the climatic average total precipitation (in mm) from April to August for all years of record at the sampling site
- $eT.clim$ - the climatic average minimum temperature in April and May
- $lT.clim$ - the climatic average maximum temperature from June to August
- lat - the latitude of the sampling site
- lon - the longitude of the sampling site

A large number of sites accross the US were sampled and doves were caught and classified as being either juvenile or adult. Of interest is the site specific "recruitment" which we define as the odds of a captured dove being a juvenile.

$$r_i = \frac{P(\text{captured dove is a juvenile})}{P(\text{captured dove is an adult})}$$

The recorded preciptation and temperature variables are hypothesized to impact recruitment.

1. An ecologist wants to compare three competing hypotheses:
   - "Global adaptation". Under this hypothesis, recruitment is only a function of the yearly weather. This indicates that all doves accross the US respond similarly to current weather.
   - "Local adaptation". Under this hypothesis, recruitment is only a function of the yearly deviation in weather patterns from the climatic average for the site. This indicates that doves are locally adapted to their climate.
   - "Differential adaptation". Under this hypothesis, recruitment is a function of both the climatic average for the site and the yearly deviation from the climatic average.

   Use the data to identify which of the three competing hypotheses is most supported by the observations. Clearly describe the relationship between your predictor variables and recruitment as defined above.

2. Additionally, the ecologist is interested in determining whether or not the effect that yearly deviations from the climatic average of the weather variables depend on the climatic average itself. For example, the ecologist is interested in answering the following question (and other, similar questions): "Does an unnaturally wet year at a location that is climatically dry affect recruitment similarly to an unnaturally wet year at a location that is climatically wet?".

3. Use the most appropriate model to provide a 95% confidence interval on the mean recruitment at a site with the following characteristics.

P	lT	eT	P.dev	lT.dev	eT.dev	Lon	Lat
6.95	31.53	9.43	1.59	0.37	0.10	-1900.45	254.51