Problem Set 2

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Due: February 19, 2023

Instructions

- Please show your work! You may lose points by simply writing in the answer. If the problem requires you to execute commands in `R`, please include the code you used to get your answers. Please also include the `.R` file that contains your code. If you are not sure if work needs to be shown for a particular problem, please ask.
- Your homework should be submitted electronically on GitHub in `.pdf` form.
- This problem set is due before 23:59 on Sunday February 19, 2023. No late assignments will be accepted.

We're interested in what types of international environmental agreements or policies people support (Bechtel and Scheve 2013). So, we asked 8,500 individuals whether they support a given policy, and for each participant, we vary the (1) number of countries that participate in the international agreement and (2) sanctions for not following the agreement.

Load in the data labeled `climateSupport.csv` on GitHub, which contains an observational study of 8,500 observations.

- Response variable:
  - `choice`: 1 if the individual agreed with the policy; 0 if the individual did not support the policy
- Explanatory variables:
  - `countries`: Number of participating countries [20 of 192; 80 of 192; 160 of 192]
  - `sanctions`: Sanctions for missing emission reduction targets [None, 5%, 15%, and 20% of the monthly household costs given 2% GDP growth]

Please answer the following questions:

1. Remember, we are interested in predicting the likelihood of an individual supporting a policy based on the number of countries participating and the possible sanctions for non-compliance.

   Fit an additive model. Provide the summary output, the global null hypothesis, and p-value. Please describe the results and provide a conclusion.

```
mod <- glm(choice ~ countries + sanctions, data = climateSupport,
family = binomial(link = "logit"))
summary(mod)

# Significance Test
null_mod <- glm(choice ~ 1, data =climateSupport, family= "binomial")
anova(null_mod, mod, test = "LRT")
# one of the factors has a significant effect on Choice

# Per factor
reducedC <- glm(choice ~ countries, data = climateSupport, family =
binomial(link = "logit"))
anova(reducedC, mod, test = "LRT")
# Effect of Countries is significant

reducedS <- glm(choice ~ sanctions, data = climateSupport,
family = binomial(link = "logit"))
anova(reducedS, mod, test = "LRT")
# effect of Sanctions is also significant
```

   Both the number of countries participating and the percent of sanctions are significant predictors in the logit regression model for individual choice to support the climate policy.

2. If any of the explanatory variables are significant in this model, then:

   (a) For the policy in which nearly all countries participate [160 of 192], how does increasing sanctions from 5% to 15% change the odds that an individual will support the policy? (Interpretation of a coefficient)

   For the policy in which 160 countries participate, increasing sanctions from 5% to 15% decreases the odds that an individual will support the policy. Specifically, with sanctions at the 15% level, the individual is e^-0.181086 or 0.8343636 less likely to support the policy than with sanctions at 5%.

   (b) What is the estimated probability that an individual will support a policy if there are 80 of 192 countries participating with no sanctions?

```
predicted_data <- with(climateSupport, expand.grid(countries =
unique(countries), sanctions = unique(sanctions)))

predicted_data <- cbind(predicted_data, predict(mod,
newdata = predicted_data, type = "response", se = TRUE))

predicted_data <- within(predicted_data,
{PredictedProb <- plogis(fit)
  LL <- plogis(fit - (1.96 * se.fit))
  UL <- plogis(fit + (1.96 * se.fit))})
```

```
The estimated probability that an individual will support the policy
if there are 80 countries participating with no sanctions is 0.6261930
```

(c) Would the answers to 2a and 2b potentially change if we included the interaction term in this model? Why?

- Perform a test to see if including an interaction is appropriate.

```
int_mod <- glm(choice ~ countries * sanctions, data =
climateSupport, family = binomial(link = "logit"))
anova(mod, int_mod, test = "LRT")
```

```
Interaction is not appropriate because there is not a significant difference
from the additive model.
```