REQUEST FOR PROPOSAL
RFP #: HK – F3.H2

TITLE: HURRICANE READINESS PROJECT – PHASE 2
CLOSING DATE AND TIME: NOVEMBER 14. 2022 @ 5:00 PM

Hurricane Readiness Project – Phase 2: HK – F3.H2

Purpose

By responding to this Request for Proposal (RFP), the Proposer agrees that s/he has read and understood all documents within this RFP package.

Submission Details

Responders to this RFP should supply:

- A business report **up to 5 pages** (not including cover page, table of contents, or any needed appendix), including any supporting plots and tables.
- The commented code used to produce the results in separate file(s).

The report should address **all points described in the "Objective" section** below.

The report should be returned in the following way:

- Electronic – Moodle submission on AA502 website

Background

Several hurricanes struck the gulf area and resulted in severe casualty and property damage. One of the major defenses is to maintain and coordinate the pump operations during a critical 48 hour period (or over 4 high tides). The Steering Committee of the Center for Risk Management (hereafter the "Committee") is conducting an analysis for the pump stations in the gulf coast area to help better prepare for future hurricanes.

Pumps may or may not fail during a hurricane. If they fail, flood waters begin to rise too quickly which leads to catastrophic damage to homes and businesses in the area and severe loss of life. Pumps can fail for a variety of reasons during a hurricane. The four currently tracked by the Committee are the following:

1. Flood – overflow or accumulation of an expanse of water that submerges the pump station.
2. Motor – mechanical failure of the pump motor.
3. Surge – onshore gush of water usually associated with levee or structural failure.
4. Jammed – accumulation of trash or landslide materials which leads to water not getting to the pump.

For further information on how New Orleans specifically has adjusted since hurricane Katrina with the upgrades of such pumps please see the following article from the Wall Street Journal:
https://www.wsj.com/articles/how-new-orleans-fortified-itself-against-water-11562981176

Objective

The scope of services includes the following:

- For this phase use **the entire** data set.
- This phase will only be focused on one type of failure (Flood). (This could easily be replicated for each type, but you are only responsible for failure in this RFP.)
- Build a model with your target variable being the time to flood events.
    - (HINT: Censor all observations that are not a Flood failure. In other words, your censor variable is now flood vs. no flood, **NOT** survive vs not survive. This process is actually called competing risks which we will be discussing later in the course.)
    - Use only main effects in this model (No interactions and no H1-H48 variables).
    - Select an appropriate distribution for your model using both graphical approaches and statistical tests.
        - Include any graphs or p-values that you use in determining the appropriate distribution.
    - Perform variable selection once you have your optimal distribution.
        - The Committee currently uses a significance level of **0.03** and backward selection to choose their models.
        - Feel free to use a different significance level and selection technique as long as you defend your reason.
    - Include a table of significant variables ranked by p-value.
    - Interpret the effects of the most significant variable.
- Analyze the pumps that failed due to flood failure and evaluate which pumps you would recommend getting an upgrade on the factors you found significant in your model.
    - You can only perform one upgrade per pump.
    - You have a fixed budget of $2.5 million and must use this money accordingly to keep pumps functioning as long as possible.
    - Provide a list of the pumps as well as the upgrades for those pumps.
        - For each pump estimate the time benefit for your upgrade.

      (HINT: Use a similar approach as we did in class where we analyzed the benefit of giving financial aid to prisoners.)

Data Provided

The following data set is provided for the proposal:

- The data set **hurricane** contains 770 observations and 59 variables.
    - All of the pumps have a reason for failure in the variable **reason**:
        - 0 – no failure
        - 1 – flood failure
        - 2 – motor failure
        - 3 – surge failure
        - 4 – jammed failure
    - There are 56 variables describing the pump's factors that potentially influence the survivability of the pump stations (not all pumps have each characteristic, but some characteristics are available through upgrade or maintenance).
- (HINT: If you are using R, use the `haven` package and the `read_sas()` function to open the `.sas7bdat` files.

Name	*Model Role*	*Description*
AGE	Input	Difference between the installation and the current date
BACKUP	Input	Redundant system used to protect the station from flooding when the main pump is not operating (UPGRADE AVAILABLE – $100K)
BRIDGECRANE	Input	Allow vertical access to equipment and protecting materials (UPGRADE AVAILABLE – $50K)
ELEVATION	Input	Elevation of the pump station that can be altered by 1 foot by maintenance (MAINTANENCE AVAILABLE – $10K/FT)
GEAR	Input	Gear box used to make the pumps stronger and faster (UPGRADE AVAILABLE – $75K)
H1 – H48	Input	Pumping status during a 48 hour emergency reported by pump stations – accuracy of pump status not guaranteed to be error free
HOUR	Target	Hour that the pump failed or was censored
REASON	Strata	Reason for pump failure (recorded as 0, 1, 2, 3, or 4)
SERVO	Input	Servomechanism is used to provide control of a desired operation through the Supervisory control and data acquisition (SCADA) system (UPGRADE AVAILABLE – $150K)
SLOPE	Input	Surrounding ravine slope of the pump station
SURVIVE	Target	If the pump survived the hurricane without failure
TRASHRACK	Input	Used for protecting hydraulic structures against the inlet of debris, of vegetation, urban or industrial trash (UPGRADE AVAILABLE – $80K)