



# COMMERCIAL BANKING, CORP

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REQUEST FOR PROPOSAL

RFP #: IP – F3.H3

TITLE: BANKING INSURANCE PRODUCT – PHASE 3

CLOSING DATE AND TIME: DECEMBER 1, 2021 @ 5:00 PM

# Banking Insurance Product – Phase 3: IP – F3.H3

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## 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 4 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.

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

The report should be returned in the following way:

- Electronic (submit via Moodle)

## Background

The Commercial Banking Corporation (hereafter the “Bank”), acting by and through its department of *Customer Services and New Products* is seeking proposals for banking services. The Bank ultimately wants to predict which customers will buy a variable rate annuity product. Previously the bank sought consulting work on the same project, but also had a focus on understanding the factors involved. Here the focus is more on predictive power.

A variable annuity is a contract between you and an insurance company / bank, under which the insurer agrees to make periodic payments to you, beginning either immediately or at some future date. You purchase a variable annuity contract by making either a single purchase payment or a series of purchase payments.

A variable annuity offers a range of investment options. The value of your investment as a variable annuity owner will vary depending on the performance of the investment options you choose. The investment options for a variable annuity are typically mutual funds that invest in stocks, bonds, money market instruments, or some combination of the three. If you are interested in more information, see: <http://www.sec.gov/investor/pubs/varannty.htm>

The project will be broken down into 3 phases:

- Phase 1 – MARS and GAMs
- Phase 2 – Tree-Based Models
- Phase 3 – Model Interpretation

## Objective – Phase 3

The scope of services in this phase includes the following:

- For this phase you will use **both** the insurance\_t dataset and insurance\_t dataset.
- Previous analysis has identified potential predictor variables related to the purchase of the insurance product so no initial variable selection before model building is necessary.
- The data has missing values that need to be imputed.
  - Typically, the Bank has used median and mode imputation for continuous and categorical variables but are open to other techniques if they are justified in the report.
- The Bank has been impressed with the predictive power of the machine learning models you have built so far. They are interested in you building at least one more machine learning model, but leave the type up to you.
  - Build an additional machine learning model of a type you haven't built so far (aka, not logistic regression, MARS, GAM, random forest, or XGBoost).
    - (HINT: You CANNOT just copy and paste the code from class. In class we built a model to predict a continuous variable. Make sure your model is built to handle a classification problem.)
- Report your final model you chose across all of the models you have built.
  - Explain the decision behind choosing this final model.
  - Report the variable importance for each of the variables in the model.
    - Pick one metric to rank things by – no need to report multiple metrics for each variable.
  - Report the area under the ROC curve as well as a plot of the ROC curve **on the validation dataset**.
    - (HINT: Use the same approaches you used back in the logistic regression class.)
- The Bank is also interested in more interpretations on your final chosen model.
  - The Bank wants a global interpretation for the variable account age. They know that this is impactful on the selling of the new product, but want a general idea as to how.
    - (HINT: Feel free to pick either PDP or ALE for this variable.)
    - Describe the global relationship of account age to for someone who does buy the new product.
  - (OPTIONAL EXTRA) The Bank has taken a special interest in observation number 732 from the training dataset. They are one of the longest tenured customers at the Bank. They want a more local interpretation for this customer.
    - Report your predicted probability from your final model for this customer and whether the customer bought the insurance product.
    - Report what factors drove your model to its prediction.
    - (HINT: Feel free to pick either LIME or Shapley values for this customer. These plots are not going to necessarily be client friendly out of the box so be ready to create your own version or just report the pertinent information from them.)

## Data Provided

The following two sets of data are provided for the proposal:

- The training data set **insurance\_t** contains 8,495 observations and selected variables.
  - All of these customers have been offered the product in the data set under the variable **INS**, which takes a value of 1 if they bought and 0 if they did not buy.
  - There are selected variables describing the customer's attributes **before** they were offered the new insurance product.
- The validation data set **insurance\_v** contains 2,124 observations and selected variables.
- The table below describes the Roles and Description of the variables found in both data sets.
  - **Except for Branch of Bank**, consider anything with more than 10 distinct values as continuous.

<i>Name</i>	<i>Model Role</i>	<i>Description</i>
<i>ACCTAGE</i>	Input	Age of oldest account
<i>DDA</i>	Input	Indicator for checking account
<i>DDABAL</i>	Input	Checking account balance
<i>DEP</i>	Input	Checking deposits
<i>DEPAMT</i>	Input	Total amount deposited
<i>CHECKS</i>	Input	Number of checks written
<i>DIRDEP</i>	Input	Indicator for direct deposit
<i>NSF</i>	Input	Number of insufficient fund issues
<i>NSFAMT</i>	Input	Amount of NSF
<i>PHONE</i>	Input	Number of telephone banking interactions
<i>TELLER</i>	Input	Number of teller visit interactions
<i>SAV</i>	Input	Indicator for savings account
<i>SAVBAL</i>	Input	Savings account balance
<i>ATM</i>	Input	Indicator for ATM interaction
<i>ATMAMT</i>	Input	Total ATM withdrawal amount
<i>POS</i>	Input	Number of point of sale interactions
<i>POSAMT</i>	Input	Total amount for point of sale interactions
<i>CD</i>	Input	Indicator for certificate of deposit account
<i>CDBAL</i>	Input	CD balance
<i>IRA</i>	Input	Indicator for retirement account
<i>IRABAL</i>	Input	IRA balance
<i>INV</i>	Input	Indicator for investment account
<i>INVBAL</i>	Input	INV balance
<i>MM</i>	Input	Indicator for money market account
<i>MMBAL</i>	Input	MM balance
<i>MMCRED</i>	Input	Number of money market credits
<i>CC</i>	Input	Indicator for credit card
<i>CCBAL</i>	Input	CC balance
<i>CCPURC</i>	Input	Number of credit card purchases
<i>SDB</i>	Input	Indicator for safety deposit box
<i>INCOME</i>	Input	Income
<i>LORES</i>	Input	Length of residence in years
<i>HMVAL</i>	Input	Value of home
<i>AGE</i>	Input	Age
<i>CRSCORE</i>	Input	Credit score
<i>INAREA</i>	Input	Indicator for local address
<i>INS</i>	Target	Indicator for purchase of insurance product
<i>BRANCH</i>	Input	Branch of bank