

### DAT 610 Module Six Exercise Guidelines and Rubric

**Overview:** Data analytics are increasingly viewed as a means of developing key risk indicators (KRIs) from the wide array of operational risk metrics that are generated across an organization. The use of the right analytic methods against properly developed operational risk data supports the goal of identifying KRIs that are most closely aligned with an organization's true risk profile.

**Prompt:** Company XYZ's chief risk officer has asked you to help determine appropriate KRIs for auto insurance loss. The company would like to understand which insurance loss categories might be KRIs for determining the lowest total average insurance loss for a particular auto model. Use the provided IIHS Data document, which uses data from the <u>Insurance Institute for Highway Safety (IIHS)</u> on insurance losses by make and model.

The data set includes vehicles from 2010 through 2012 model years. The relative insurance loss (100 is average, less is better, higher is worse) categories include average of all category loss, collision, property damage, comprehensive, personal injury, medical payment, and bodily injury.

Copy and execute the following R commands (in the color red) to produce results for the following analytical methodologies:

Load the data, change the file path or use "Import Dataset" in RStudio

iihs\_data <- read.csv("~/iihs\_data.csv")
View(iihs\_data)</pre>

## 1. Principal Components Analysis

Describe how the results of the principal components analysis in R might be used to derive KRIs.

```
model <- princomp(~.,iihs_data[1:75,3:8], na.action=na.omit)
summary(model)
screeplot(model)</pre>
```

# 2. Linear Regression

Describe how the results of linear regression analysis in R might be used to derive KRIs.

Add a "Buy" column to the data set that reflects a buy signal (true = 1 or false = 0) based on the average of all category losses.

```
iihs_data_tr <- transform(iihs_data,Buy = as.numeric(iihs_data$Average.Loss < 100))
View(iihs_data_tr)</pre>
```

Use the Im function for linear regression model

Im\_model=Im(iihs\_data\_tr\$Buy ~ iihs\_data\_tr\$Collision. + iihs\_data\_tr\$Property.damage. + iihs\_data\_tr\$Comprehensive. + iihs\_data\_tr\$Personal.injury. + iihs\_data\_tr\$Medical.payment. + iihs\_data\_tr\$Bodily.injury.)

summary(Im model)

What does the "Estimate" column values for the loss categories signify in terms of value and sign for possible KRI assignment?

## 3. Logistic Regression

Describe how the results of logistic regression analysis in R might be used to derive KRIs.

 $Ig_model = glm(iihs_data_tr\$Buy \sim iihs_data_tr\$Collision. + iihs_data_tr\$Property.damage. + iihs_data_tr\$Comprehensive. + iihs_data_tr\$Personal.injury. + iihs_data_tr\$Medical.payment. + iihs_data_tr\$Bodily.injury.,family = "quasibinomial",na.action=na.omit,control = list(maxit = 50))$ 

summary(lg\_model)

What does the "Estimate" column values for the loss categories signify in terms of value and sign for possible KRI assignment?

#### 4. Set of KRIs

From the above analysis, identify an appropriate set of KRIs for determining the lowest total average insurance loss for a particular auto model.

**Guidelines for Submission:** This submission must be one to two pages in length and must use double spacing, 12-point Times New Roman font, and one-inch margins. Citations must use APA format.

#### Rubric

Critical Elements	Exemplary (100%)	Proficient (90%)	Needs Improvement (70%)	Not Evident (0%)	Value
Principal	Meets "Proficient" criteria	Describes the use of	Describes the use of	Does not describe the use of	25
Components	and aligns results to	principal components	principal components	principal components	
Analysis	Company XYZ's goals	analysis to identify a subset	analysis to identify a subset	analysis to derive KRIs	
		of reduced-dimension risk	of risk metrics to use as KRIs		
		metrics to use as KRIs			
Linear Regression	Meets "Proficient" criteria	Describes the use of linear	Describes the use of linear	Does not describe the use of	25
	and aligns results to	regression analysis to	regression analysis to	linear regression analysis to	
	Company XYZ's goals	identify a subset of	identify a subset of risk	derive KRIs	
		reduced-dimension risk	metrics to use as KRIs		
		metrics to use as KRIs			

Logistic Regression	Meets "Proficient" criteria and aligns results to Company XYZ's goals	Describes the use of logistic regression analysis to identify a subset of reduced-dimension risk metrics to use as KRIs	Describes the use of logistic regression analysis to identify a subset of risk metrics to use as KRIs	Does not describe the use of logistic regression analysis to derive KRIs	25	
Set of KRIs	Meets "Proficient" criteria and aligns results to Company XYZ's goals	Describes the use of principal components, linear regression, and logistic regression analyses to identify a subset of reduced-dimension risk metrics to use as KRIs	Describes the use of principal components, linear regression, and logistic regression analyses to identify a subset of original risk metrics to use as KRIs	Does not describe the use of principal components, linear regression, and logistic regression analyses to derive KRIs	25	
Total						