MATH 283

Comprehensive Project

**Project Information**

This project is intended to cover many of the topics that you’ve worked on during the course of this project. The project is due prior to the final class on **April 24, 2018.**

The project involves work in Excel, and Access. In general, the processing relies on processing in Access, then work in Excel.

The intent with this project is to provide less specific direction on the project compared to the homework. Most, if not all, the formulas used in this example can be found in the examples and homework that we’ve covered so far in class.

There will be a portion of the grade based on my subjective evaluation of efficiency and simplicity of calculations.

I will give each of you one state to calculate indicated rates, see below. You should hand in print outs for the state when you turn in your project.

|  |  |  |  |
| --- | --- | --- | --- |
| Student | State Assignment | Student | State Assignment |
| Agyemang, Eric (EAGYEM2) | AZ | Kenyon, Lauren E (LEKENY1) | OH |
| Arhin-Donkor, Seth (SARHIND) | GA | Liu, Quanshuai (QLIU123) | NE |
| Damery, Scott C (SCDAMER) | IN | Park, Kie-Won (KPARK12) | NJ |
| Kalata, Robert Sebastian (RSKALAT) | KY | Reed, Eric J (EJREED1) | NM |
| Kaufman, Matthew D (MKAUFMA) | LA | Roesler, Daniel A (DAROESL) | WY |
| Kelly, Peyton E (PEKELLY) | OK | Triplo, Levi D (LDTRIPL) | TN |

**The Situation**

You are a pricing actuary for ABC Insurance Company, a small personal lines auto insurer with premium revenue of approximately $300M annually.

One of your job responsibilities is to develop periodic rate level indications, as well as adjustments to your rating factors. Your boss has asked you to put together a process to streamline the indications process for developing indicated rates for 2011. To do so, he has provided the following instructions as well as a shell of what he would like the spreadsheet to look like.

He has also asked you to provide a separate way for him to keep an eye on pure premium trends in all states, and compare to countrywide (CW) trends. He’d like a simple point and click method to do this, so you’ve suggested a PivotChart for this purpose.

Developing a rate indication at ABC involves a few steps including:

* Trend Analysis
* Development of Loss Projection Factors based on Trends
* Developing indicated Deductible and Class (Age & Sex) Factors
* Development of Investment Yield
* Development of overall rate indication

To develop the rate indications, you have been given the following information:

* The IT department has provided detailed premium and loss information for all policies 2007-2009 in a fixed width text file. This file has about 1 million records, so it must be first processed in Access.
* You also have a copy of the latest Fast Track industry trend data in an Access database
* You have an Excel spreadsheet with the company’s stock holdings and purchases, as well as historical prices for those stocks over the past 4 years.

Your rate indications process will include the following output (explained in more detail below):

* An Access database that has queries that output data that can be copied into Excel for each state.
* An Excel spreadsheet that shows the calculation of the average investment yield for 2007-2009
* An Excel spreadsheet that calculates the indicated rate change, after pasting the output of the access queries and investment yield into it. This spreadsheet should allow the user to paste the access output for another state into Excel, and automatically generate the indicated rate without any additional updates.
* An Excel spreadsheet with a PivotChart that displays both the CW trend and the State trend.

There is an example of what the output from the rate indications worksheet should look like.

**Access Portion**

An Access database is provided. That database already contains a table named TrendData, which has the industry trend data.

You have also been provided with detailed policy data on policydata.txt. The layout for the text file is below:

Pos Field

1-2 Keys

3-4 State

5-8 Deductible

9-14 Class Code

15-18 Year

19-24 Premium

25 Indicator whether policy had claim

26-35 Claim Amount

Note on Keys field. Please use Access to add a primary key. The keys field in the input dataset is truncated. (Thus not unique to each record.) However, it will not impact your calculations.

You should import the text file with the policy data into an Access table.

In Access, you should create queries that outputs the following information:

Company Premium/Loss Information:

STATE (Group By)

YEAR (Group By)

DEDUCT (Group By)

CLASS (Group By)

Policy Count (Count)

PREM (Sum)

CLAIM\_IND (Sum)

LOSS\_AMOUNT (Sum)

You should set the query to have a where clause for the state. You can change the state to whichever state you are working on.

Industry Fast Track Trend Information:

STATE (Group by)

YYYYQ (Group by)

Cov (Group by)

CW\_CARYEARS (Sum)

CW\_PDCOUNT (Sum)

CW\_PDAMT (Sum)

STATE\_CARYEARS (Sum)

STATE\_PDCOUNT (Sum)

STATE\_PDAMT (Sum)

The CW fields are summaries based on all data for all states. The STATE summary fields are sums of the fields for the particular state. Again, you should set up the query for the Where clause to specify the state that is to be outputted.

Note that to get both CW summaries and STATE summaries on the same query, you’ll have to merge the output of two separate queries (one at the state level, and one at the CW level) and merge the results by YYYQ and COV.

**Excel Investment Yield Worksheet**

The spreadsheet provided has two tables. One table has the stock prices over time for stocks on the S&P 500. ABC Company owns a subset of those stocks. The investment department has a provided a summary of the stocks held at the beginning of year (BOY) 2006, as well as stocks purchased on 1/1/2007, 1/1/2008, and 1/1/2009.

You need to calculate the investment yield for 2007, 2008, and 2009, and the arithmetic average of the 3 year yield. A demonstration of the calculation is included the handout. You should fill out the spreadsheet on the Investment Yield Calculation of the worksheet.

The value that you calculate in this worksheet will be entered in the Rate Indications worksheet.

**Excel Rate Indications Worksheet**

The output from Access should be pasted into the Input Data tab of the worksheet. Feel free to add any index columns to this tab that might be useful to you later on. You should also be able to input the State Name on that tab and have the resulting State name flow to all the Worksheet headers in the worksheet (so if you paste data for a new state, you only have to change the state name once in the worksheet, rather than having to update every sheet).

Keep in mind that *no other changes should be necessary when updating a state*. Think about the possibility of queries for different states returning a different number of rows. You may need to use larger references to the InputData tables than you would for the state data that is in there already.

Included in the handout is an example of what the excel output should look like for the other worksheet tabs. I’ve listed some tips on completing each sheet on handout.

Trends Worksheets

Get the trend information from the output of the Fast Track query. Your company uses only industry data for trend analysis, and weights the state experience with the CW experience to develop its trends.

Use the LINEST and the INTERCEPT formulas to calculate the appropriate values. Feel free to put index (1,2,3,…) in column A for your X-values. Your Y-values should be Pure Premium column. Remember, Pure Premium = Loss Amount / Car Years. Use these values to calculate the fitted values columns. The annual change is 4 x the slope (for four periods). Express this as a % trend by dividing the annual amount by the most recent fitted value

Create a graph as shown in the handout with 4 series, State and CW, fitted and actual.

Create a trend exhibit for all coverages shown. Keep in mind that you can copy of the first tab you complete by right clicking on it, and say move or copy, then make a copy. If you code the first tab right, you should just be able to copy it, change the coverage reference, and you won’t have to repeat any of the remaining work.

Loss Projection Factor Worksheet

The trends calculated for each coverage should pull through to this worksheet. There is a credibility weighting calculation on this spreadsheet. The credibility given to the experience of a given state is based on the number of claims for that state in the most recent period. (For example, if the state 2010 Q1’s claim count for BI is 123,245; the credibility weight assigned should be 0.4.) Those should be pulled from either the trend worksheets, or the raw data on the input data tab.

The formula for weighted trend

= State Trend \* Credibility weight + CW Trend \* (1-Credibility weight).

You also should include the loss amount for the most recent period. This is used to calculate a weighted average trend for all coverages (cell H13), based on the state’s coverage distribution.

At the bottom of the worksheet, the LPF is calculated. The LPF Formula = 1 + # Years Projected \* Selected Trend. For the selected trend, use the credibility weighted all coverage trend from above.

Deductible and Age/Sex Factor Worksheets

Get the policy count, premium, and loss information for all three years from the company experience data on the input data tab. Calculate the loss ratio, indicated change, and indicated rate factors. The indicated change calculation is shown on the spreadsheet. The indicator factor = Current Factor x (1 + indicated Change).

One both worksheets, add a conditional format to the indicated change column to highlight cells that have a greater than 10% increase, or less than -10% decrease.

Indicated Change Worksheet

Pull the premium and loss information from the company experience data on the input data tab. Pull the LPF from the Loss Projection Factor tab. Calculate the projected losses = Actual losses x LPF.

Use the Projected loss ratio for the 3 year period in the indicated change formula at the bottom of the worksheet. Manually input the investment yield from your investment yield worksheet. For the other values in the formula, use the values in the attached example.

**Excel PivotChart Worksheet**

Your boss would also like a way to keep track of trends, without having to do all the work involved with setting up an indications worksheet. You’ve agreed to create a PivotChart that shows pure premium trends.

To generate the source data for this PivotChart, you should be able to use the same query as you used to generate the trend data that you pasted into the Indications worksheet. The main difference is that you should remove the specific state when executing that query. The query should return the values for all states, as well as columns that contain the CW values. Paste the output of the query into a new Excel workbook.

Create a PivotChart. The PivotChart should have Page fields of Coverage and State. The time period (YYYQ) should be displayed across the bottom of the chart. The data elements in the chart area should include the state pure premium, and the CW pure premium.

Handing Project In

You need to submit both paper & electronic files. Please print the excel files and hand them in class on 4/24. You can upload electronic files to ReggieNet prior to the class. Electronic files should include:

* The Access database with the policy data loaded and all queries created.
* The Excel Investment income yield spreadsheet
* The Excel Indications spreadsheet
* The Excel PivotChart spreadsheet

Grading:

Access Portion (14 pts)

Load Policy data into table (4 pts)

Create Company Experience Query (4 pts)

Create Nested Trend Queries (6 pts)

Excel Investment Income Worksheet (5 pts)

Excel Indications Worksheet: (16 pts):

Trend Exhibits (4 pts)

Loss Projection Factor Worksheet (2 pts)

Deductible Worksheet (4 pts)

Age Worksheet (4 pts)

Indicated Change Worksheet (2 pts)

Excel PivotChart Worksheet (5 pts)

For each section listed above, up to 10% of the grade will be based on my subjective evaluation of efficiency. This includes using a minimal (if any) number of interim cells for calculations, using absolute and relative row/column references when appropriate, and using the most appropriate formula for the task at hand.