1. **Goal: Construct a Loss Triangle and Estimate IBNR**

There are many ways to estimate the IBNR, and the method demonstrated below is the Loss Development Method. The following are done in the "Claims Data" tab.

Step 1: Construct the loss triangle [Table 1]

Since the data is organized by the date incurred and date paid, create a sorting code that uses both, and use Vlookup to construct a table where the rows represent date incurred, and columns represent date paid.

Step 2: Calculate the accumulated paid amount by the number of months (in 6-month increments) after the loss is incurred [Table 2]

For example, for the claims incurred in 201201, calculate the total paid amount in the first 6 months (201201 throgh 201206), first 12 months (201201 through 201212), ect.

Step 3: Calculate the development factors [Table 3]

For example, calculate the ratios of claims paid in the first 6 months to that of the first 12 months, and similarly for 12 to 18, 18 to 24, ect.

Step 4: Estimate the paid amounts for future months [Red portion of Table 3 and Table 2]

First, fill in the completion factors that are missing in Table 3 by simply taking the average of the corresponding completion factors that we have data for. Then use these to estimate the claims paid in the missing months of Table 2. For the most recent five months of incurred dates, estimate the claims paid in the first 6 months as the average of that of the rest of the months of incurred dates.

Step 5: Estimate the IBNR [Table 2]

Since we have an estimate of how much the claims incurred at every given month will ultimately cost, we can subtract from it the total amount of claims already paid out for that month. (What if this is negative? This is very likely since the development factors are all very close to 1.) Sum them up to get an estimate of the IBNR.

2. **Analyze the Trend of Average Cost PEPM**

The total cost is the claims already paid out plus the incurred but not paid claims, so add these together and divide by the number of members active at each month for which the claims are incurred to calculate the average cost per enrollee per month. The calculations are done in the "Enrollment Data" tab.

Step 1: Calculate the total cost [Table 4]

The total cost of claims incurred at a given month is simply the ultimate accumulated paid amount constructed in Table 2 above.

Step 2: Calculate the average cost PEPM [Table 4]

Divide the total claims cost for claims incurred each month by the total number of enrollees for that month.

Step 3: Analyze the trend and seasonality for the average cost PEPM

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3. Change the Plan Design to Reflect a Change in Actuarial Value

The actuarial value is the average proportion of the claims that is paid by the insurance company as opposed to the enrollees.

$$Actuarial\ Value = \frac{Total\ Claim\ Amounts\ Covered}{Total\ Claim\ Amounts\ Incurred}$$

$$
\begin{aligned}
Total\ Claim\ Amounts\ Incurred &= \frac{Total\ Claim\ Amounts\ Covered}{Actuarial\ Value} \\
&= \frac{\$1.39\ billion}{0.895} \\
&= \$1.55\ billion
\end{aligned}
$$

$$
\begin{aligned}
New\ Projected\ Claim\ Costs &= New\ Actuarial\ Value * Total\ Claim\ Amounts\ Incurred \\
&= 0.832 * \$1.55\ billion \\
&= \$1.29\ billion
\end{aligned}
$$

$$
\begin{aligned}
\%\ Change\ in\ Proj.\ Claim\ Costs &= \frac{\$1.29\ billion - \$1.39\ billion}{\$1.39\ billion} \\
&= -7\%
\end{aligned}
$$

Due to the adjustment of out-of-pocket maximums, the actuarial value decreased by 7%, which means that the insurance company will be expected to pay 7% less than before on future claims. Therefore, the projected claim costs will also decrease by 7%.