**Future Apartments Complex**

Student Instructions

**Introduction**

N.B. All tables and graphics (in the right hand column below) are merely examples; the data in the tables & graphics are not the data for this assignment.

Student - The data for this assignment are at the end of this Word document i.e. Exhibits 1, 2 & 3.

You are a potential purchaser of the Futura Apartments complex. You have researched the situation to help you make a knowledgeable decision. Your work has led you to make the following assumptions:

1. You have obtained the history of average monthly rentals for this year and the past 12 years – see Exhibit 1
2. $500 is the going rent for the area and you expect a standard deviation of 10%
3. An analysis of units rented and average prices charged for the past 12 years generated the data in Exhibit 2.
4. You have obtained the history of average monthly expense for this year and the past 12 years, see Exhibit 3

You need to complete the following tasks and you may think of this assignment in four stages:

1. Get the data ready
2. Prepare the Monte Carlo simulation model
3. Prepare the deterministic information
4. Prepare the Monte Carlo simulation information - tables and charts

**Your Workbook**

Name your workbook:

Futura & your firstname &lastname.XLSX

e.g. FuturaLucaPacioli.XLSX

In this assignment, you will create the following sheets:

* Worksheets: AlgebraicModel, PivotTable, RelevantTables
* Chart Sheets: PT Chart, ForecastingRentals to Surface are chart sheets, only created when you get to that stage of the assignment when you need a chart.

To Create Chart Sheets Review the Microsoft Help

<https://support.office.com/en-us/article/Create-a-chart-from-start-to-finish-0baf399e-dd61-4e18-8a73-b3fd5d5680c2>

Therefore, at the conclusion of the assignment your workbook tabs will appear as follows:



**Get the Data Ready**

1. Forecast the units rented for the next 5 years. Use the data in Exhibit 1.
   1. Use the Excel FORECAST.ETS function to forecast the *Units rented* for the next 5 years.
      1. Excel FORECAST.ETS function parameters:
      2. Seasonality assume 1
      3. Data completion assume 1
      4. Aggregation assume blank
   2. Use the Excel FORECAST.ETS.CONFINT function to return the 95% confidence interval for each forecast value. Generate both the + and – 95% confidence intervals.
      * + 1. Excel FORECAST.ETS function parameters:
      1. Confidence\_level assume 0.95
      2. Seasonality assume 1
      3. Data completion assume 1
      4. Aggregation assume 1
2. Prepare a chart (scatter with smooth lines) of your Exhibit 1 data and your forecast and confidence interval data. Create the chart as a separate chart sheet.

Chart sheet name ForeCastingRentals

1. Enter the *Rental price per unit* and standard deviation.

Pent per unit $500 and standard deviation 10%

1. Using the data in Exhibit 2 calculate the correlation between the *History rentals* and the *Average Rent per month*.









1. Using the data in Exhibit 3, use regression to calculate the variable cost per rental unit and the fixed cost per month.
2. Use Excel LINEST to calculate the parameters in the cost function y = mx + b where m is the variable cost coefficient (i.e. slope) and b is the fixed cost coefficient (i.e. intercept).
   1. Calculate the *t* value and threshold using TINV() function
   2. Calculate the Minimum, Maximum, Standard deviation (=SQRT(R19^2+S19^2+R20^2-R19\*S19-R19\*R20-S19\*R20) for the variable cost coefficient (m) and the fixed cost (b) using the results from LINEST.
3. Prepare a chart (scatter) of the *Units Rented* and the *Actual Expense*.
   1. Add a linear trendline to your chart; check the boxes “Display Equation on chart” and “Display R-squared value on chart”. Create the chart as a separate chart sheet.
4. Notice the LINEST results are identical to the chart y = mx + b

Chart sheet name Regression





**Prepare the Monte Carlo simulation model**

1. Prepare a correlation matrix for the correlation between the *Number of rental units* and *Rent per month*. You calculated the correlation above in step 3.
   1. The Determinant must be positive – this is a requirement of the Cholesky algorithm; below we pass this correlation matrix and returned from Cholesky will be 2 correlated uniform random values on the interval 0 to 1.
   2. When the 10,000 rows of the MCS model are created, test the correlation of *Number of rental units* and *Rent per month* and the correlation should be very close to the correlation matrix value.
2. Make sure you have the MCSLibrary.XLSM file open and available for your MCS model.
3. Select an area of your spreadsheet for the MCS model – should be safe to select cell A40 to start entering the iterations for your MCS model.
   1. Create 2 correlated uniform random values on the interval 0 to 1, enter in cells A40:B40 =MCSLibrary.xlsm!CorrelatedUniform($C$31:$D$32)
   2. Number of rental units, enter in cell D40 =MCSLibrary.xlsm!TriangularRnd(A40,$F$18,$G$18,$H$18)
   3. Rent per month enter in cell E40 =NORM.INV(B40,$G$24,$G$24\*$H$24)
   4. Total rental income, enter in cell F40 =D40\*E40
   5. Variable cost, enter in cell G40 =NORM.INV(RAND(),$S$19,$R$21)\*D40
   6. Fixed cost, enter in cell H40 =MCSLibrary.xlsm!Uniform($T$19,$U$20)
   7. Total monthly expense, enter in cell I40 =G40+H40
   8. Monthly profit (loss), enter in cell J40 =INT(F40-I40)
   9. Iterate the model 10,000 times - copy range A40:J40 down 10,000 rows
4. Create the following tables for relevant charts.
   1. PDF & CDF table
      1. Bins – create 13 bins anchored by the minimum and maximum values in the MCS *Monthly Profit (Loss)*
      2. Use FREQUENCY to count the number of *Monthly Profit (Loss)* within the Bins.
      3. Create the PDF of the frequency.
      4. Create the CDF of the frequency.
   2. Tornado chart data *Monthly Profit (Loss)*
      1. Sequence - enter values 1 to 4, for the 4 PDFs in the MCS model
      2. Assumption - enter the assumption descriptions
      3. Correlation - use CORREL() to determine the correlation between the assumption and the *Monthly Profit (Loss)*
      4. Absolute use ABS() to determine the absolute value for the CORREL()
      5. Sort the correlation data, using the Excel functions:
         1. RANK()
         2. INDEX(,MATCH())
   3. Tornado chart data *Total rental income*
      1. Repeat the above for *Total rental income*





Copy down – need 10,000 rows  
(model iterations)









**Prepare the deterministic information**

1. Insert RelevantTables worksheet.
2. Prepare a budgeted *Profit (Loss)* statement

**Prepare the Monte Carlo Simulation information - tables & charts**

1. For your MCS output prepare the following table and charts.
   1. Table of descriptive statistics *Monthly Profit (Loss)*

Use the Excel functions: AVERAGE, MEDIAN, MODE, STDEV.S, VAR.S, KURT, SKEW, MIN, MAX, SUM, COUNT

* 1. Table Relevant Probabilities

Using Excel functions answer the relevant statistics of information for *Monthly Profit (Loss)*.

|  |  |
| --- | --- |
| Descriptive Term | Use Excel Functions |
| Probability of deterministic value | INDEX, MATCH |
| nearest PDF match | Array formula, INDEX, MATCH, MIN, ABS |
| Probability at least | COUNTIFS |
| Probability greater than | COUNTIFS |
| Pareto 80/20 rule | 80%, INDEX, MATCH |
| Probability will not have positive deterministic value | COUNTIFS |
| Probability will have positive deterministic value | COUNTIFS |
| Probability value within range | COUNTIFS |







1. Prepare a probability density function of the *Monthly Profit (Loss)* - create the chart (clustered column) as a separate chart sheet.

Chart sheet name PDF

1. Prepare a cumulative density function of the *Monthly Profit (Loss)* - create the chart (scatter with smooth lines) as a separate chart sheet.

Chart sheet name CDF

1. Prepare a Tornado chart of the *Monthly Profit (Loss)* - create the chart (clustered bar) as a separate chart sheet.

Chart sheet name Tornado1

1. Prepare a Tornado chart of the *Total rental income* - create the chart (clustered bar) as a separate chart sheet.

Chart sheet name Tornado1









**Based on the professor’s instruction use either cell formulas or a Pivot table for this question.**  Determine the optimum *Rental per unit* (approximately) to charge.

1. Cell formulas
   1. Create the table
      1. Rows -> 13 intervals of *Rental per unit*
      2. Columns -> 13 intervals *Monthly Profit (Loss)*
      3. Cells count of row column intersection – use COUNTIFS() to count.
      4. Add conditional formatting to highlight maximum frequency count
      5. SUM the counts to ensure the matrix of counts sums to the number of iterations.
   2. Create the chart (3-D Surface) as a separate chart sheet.

Chart sheet name Surface

1. Pivot Table and Pivot Chart
   1. Using the MCS data create the following pivot table.
      1. Add conditional formatting to highlight maximum frequency count
      2. Use row and column field Group… to create the PT.
   2. Create a 3-D Surface chart based on the above pivot table.

Chart sheet name PT Chart









1. Press the F9 key (or select Formulas -> Calculate Now) multiple times to test your MCS model, tables and charts are generating correctly.
2. If you have the Pivot table option, you will need to refresh the pivot table after each F9.

**Exhibit 1**

**History Rentals**

|  |  |
| --- | --- |
| Year | Units Rented |
| 2005 | 332 |
| 2006 | 304 |
| 2007 | 342 |
| 2008 | 315 |
| 2009 | 352 |
| 2010 | 399 |
| 2011 | 361 |
| 2012 | 337 |
| 2013 | 376 |
| 2014 | 342 |
| 2015 | 378 |
| 2016 | 345 |
| 2017 | 380 |

**Exhibit 2**

**Rent per Month**

|  |  |
| --- | --- |
| Year | Average Rent Per Unit |
| 2005 | $470 |
| 2006 | $500 |
| 2007 | $480 |
| 2008 | $500 |
| 2009 | $480 |
| 2010 | $460 |
| 2011 | $480 |
| 2012 | $500 |
| 2013 | $480 |
| 2014 | $510 |
| 2015 | $490 |
| 2016 | $520 |
| 2017 | $500 |

**Exhibit 3**

**Monthly Expense**

|  |  |
| --- | --- |
| Year | Expense |
| 2005 | $152,986 |
| 2006 | $134,065 |
| 2007 | $161,932 |
| 2008 | $140,681 |
| 2009 | $156,542 |
| 2010 | $178,882 |
| 2011 | $157,660 |
| 2012 | $137,082 |
| 2013 | $159,107 |
| 2014 | $136,997 |
| 2015 | $166,111 |
| 2016 | $142,674 |
| 2017 | $160,000 |