**Optimization: 15 Points**

**Questions to Answer:**

* **What are the decision variables, constraints, and objective?**
* **How many windows and doors do you recommend installing?**
* **What is the max profit?**

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DLS Enterprises is a window and door installation company. DLS Enterprises LLC wants to decide what their maximum profit could be assuming the following:

* Labor Revenue per window and door installed is $170 and $285, respectively.
* It takes an average total time of 2 hours and 5.20 hours per window and door, respectively.
  + Average total time is comprised of install time and administrative time associated with each window and door.
* DLS Enterprises LLC doesn’t want to work more than 1,500 hours a year.
* The ratio of windows to doors installed needs to be equal to 3.
* In addition to Labor Revenue, DLS Enterprises bills for materials and applies a 10% materials markup.
* Formulas:
  + Use the following formulas to calculate material revenue and material markup:
    - Material Revenue = (labor revenue / 40%) \* 60%
    - Material Mark-up = 10% \* Material Revenue
  + Total Revenue = Labor Revenue + Material Revenue + Material Mark-up
  + Cost of Goods Sold = Material Revenue
  + General Expenses = $10,000
  + Operating Income = Total Revenue – COGS – General Expenses
  + Taxes are 10% of Operating Income
  + Max Profit = Operating Income – Taxes

**Example Profit and Loss Statement**



**Simulation: 15 Points**

**Questions to answer:**

* **What reduces DLS Enterprises’ profitability?**
* **If constraints were flexible, what are the other ways DLS Enterprises could improve profitability within the confines of this scenario?**

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In reality, DLS Enterprises LLC’s average total time varies from job to job. Applying a similar approach to what we did in the Swirltubs’ case, use the rand () function in excel to introduce randomness to average total time.

* Use Norm.Inv(Probability, Mean, Standard Deviation)
  + Assume the standard deviation for average total time is 30 minutes.
  + The meaning is average total time.
  + Probability is rand ()
* With random average time per window and door unit, you can assess how the # of units installed changes for doors.
  + Assume the number of windows installed stays the same as the number of windows installed under the optimization scenario.
  + Then, calculate the time spent installing windows with the new random average total time for windows.
  + From here, solve for the time left to install doors, and given that time, the # of doors installed.
  + Rebuild your profit and loss statement using the formulas from the optimization scenario.
* Now, build a simulation using 50 replications. The variables of interest are Labor Revenue, Profit, Labor Revenue per Hour, and Profit per Hour.
  + Calculate the average, max, min, and standard deviation for each of the variables of interest.