EM384: Analytical Methods for Engineering Management
AT 23-2
Name:
Section :

Homework Set 2

This assignment is worth 20 points, and is due NLT 1700 the day of Lesson 9. Late submissions will be penalized 4 points (5% of the assignment) for each 24-hour period late after the due time.

- **Documentation**. This deliverable is an individual assignment. Any assistance received must be documented in detail. Document all sources in accordance with the Office of the Dean Pamphlet "Documentation of Academic Work," (June 2015), Appendix E, and course guidance. e-Acknowledge documentation must be turned in through CIS at the time of submission. The deliverable is considered late until all portions of the assignment and the documentation are submitted.
- **Turn-In Requirement**: **You will turn in two files to Microsoft TEAMS. The first file is this assignment with your answers to questions, saved as PDF file. The second file is your Excel file.**. The file naming convention follows:

  Section_LastName_FirstName_EM384_Homework_2

  For example, the following Excel file name would be used for Cadet Jane Smith, in Section B1, Homework Set 2:

  B1_Smith_Jane_EM384_Homework_2

  Remember that engineering management is about communicating. You will be graded on the clarity and structure of your models.
- **Acknowledgement Statement**: This assignment must be accompanied by a signed e-Acknowledgement Statement (DAW) to be eligible for graded credit. If you submit your files(s) but fail to sign the e-Acknowledgement Statement, your assignment will be considered late until the e-Acknowledgement Statement is signed.
- **Guidelines for Documenting Assistance**: For this assignment, individual work is highly encouraged, but collaboration between individuals is allowed. ALL collaboration must be documented. Any discussion of this problem set with anyone other than an EM384 instructor requires documentation. Documentation must be specific and detail the topics discussed and actions taken.
- You must be very specific (which problem, what assistance, etc.) when explaining any assistance used in your documentation or you will be deducted at a higher penalty. Assistance *may* result in a deduction of points in accordance with a holistic assessment by your instructor.
- Sharing of electronic files via email or any other electronic means is strongly discouraged. Using, copying, or being dictated someone else's work will result in a greater point deduction.

1. **Sensitivity Analysis (10 Points)** You have decided to start a micro-brewery with single boiler. Based on some initial research you found that you can brew up to 7 batches of beer each year. A boiler produces 988 kegs of beer per batch. Each keg costs you $12 to produce. Additionally, it costs $150,000 total per year to operate and rent the brewery. You plan on selling your beer for $80 per keg and market research has shown that demand for your beer will be *up to* 9,000 kegs annually (though you cannot sell more than you produce).

   (a) **(4 Points)** In a spreadsheet tab titled **1.a**, first model (and determine) the annual profit if you produce 7 batches (**Base case**) of beer per year, and demand is 9,000 kegs annually. Ensure your model is clear and well presented.

   (b) **(2 Points)** In a spreadsheet tab titled **1.b**, copy your model from part **1.a**. What is the lowest price you can sell your beer at (per keg) and break-even on this venture? Ensure you put the new price per keg in the appropriate parameter cell. Write your answer below out to two decimal places.

   (c) **(2 Points)** In a spreadsheet tab titled **1.c**, copy your model from part **1.a**. If you sell your beer at $80 per keg, what is the demand level that gives you $200,000 of profit? Ensure you put the new demand level in the appropriate parameter cell. Round your answer to a whole number of kegs.

   (d) **(2 Points)** In a spreadsheet tab titled **1.d**, copy your model from part **1.a**. If you can produce as many batches as you want from your boiler, could you feasibly earn $1,000,000 of profit? Use your model to explain your answer.

2. **Chicago Crime. (10 Points)** Examine the dataset on Chicago crime over the past year. (City_of_Chicago_Crime_Data tab).

   (a) **(1 Point)** How many records are there?

   (b) **(1 Point)** How many fields are there?

   (c) Create pivot tables (one per question) to answer the questions below. Recommendation: make a separate tab appropriately named for each question's pivot table (i.e. 2.c.i, 2.c.ii, etc.) in order to separate your work for each question. For each question, use your pivot table to answer the question in the space provided.

      i. **(2 Points)** Using the **primary type** field in the data, which two crimes had the highest frequency (i.e. which two crimes occurred the most)?

      ii. **(2 Points)** How many **arrests** occurred at a **bank** for **robbery**?

      iii. **(2 Points)** Which Ward appears to be the most dangerous for **assault arrests** (i.e. highest number of **true** assault arrests)?

      iv. **(2 Points)** Create a pivot table that shows the total number of incidents by **beat** and **primary type** that did not lead to an arrest. How many non-arrest incidents occured for **criminal trespass** from **beat** 1614?