

Instructions: Each assignment will include a PDF file (like this one) with the assignment questions and an Excel file, with an Answers sheet and any data or models that we provide you with. You must download both the PDF and Excel files. You have to enter your answers in the Answers sheet of the same Excel file you have downloaded, then save and upload the Excel file. You must upload the same Excel file you downloaded. Further instructions are provided in the Online Assignment Tools Guide (see **Assignments** in eClass).

Put your answers in the appropriate cells (salmon-colored cells) in the **Answers** sheet. Use paste special ... values to for all numerical answers. The other cells in the Answers sheet are locked, which means you won't be able to enter values into those cells. Do not change the format of cells in the Answers sheet. Save your file with the appropriate name and in the appropriate format ("HW#_ID.xlsx").

Marking will be based on the answers in the Answers worksheet of the file you upload. We will only look at the rest of the file if there is an appeal (and even then, the answers in the Answers sheet take precedence.) If you wish to appeal a mark, then the file you uploaded must include your supporting work for each question. It is a good idea to make one worksheet for each question.

Total points: 22, of which 2 points are for following the submission instructions provided above.

Distribution Planning for Red Dog Beer: Please start by reading "Case 9: Red Dog Beer Company" on pages 132-133 in the course pack.

1. (4 pts.) The purpose of this question is to help you understand how the *annualized equivalent* of the capital and operating costs of a facility is determined. Suppose that we consider a 10-year planning horizon, starting now ("time 0") and ending 10 years from now ("time 10"). The capital cost of building a plant is \$1,000,000, incurred at time 0. The operating cost is \$150,000, incurred at the end of each of the 10 years. All this data has been provided in the "Annualized" worksheet. Using a discount rate of 5.0%, determine and report the net present value (NPV) of the capital and operating costs. Next, determine and report an annualized capital and operating cost, incurred at the end of each year, that has the same NPV as the actual capital and operating cost.

Hint 1: Learn to use the NPV function.

Hint 2: Three possible ways to find the annualized capital and operating cost are 1) to find an Excel function that provides the answer in one step, 2) to use solver, or 3) to use a data table. If you use solver, note that it is possible to run solver without an objective cell. In that case, solver simply tries to find a solution that satisfies all constraints that you have entered.

The Red Dog case describes the situation as it was long time ago. Since then, the following has happened:

- Red Dog sold its current Calgary facility.
- The company opened a new facility in Edmonton. The annualized capital and operating cost of this facility is \$1,000,000 per year, it is capable of producing up to 5,000 truckloads of beer per year, and the variable production cost is \$750 per truckload. These values are higher than the values given in the case because of inflation and because of changes in the design of the facility.
- The proposed new facilities in Calgary, Red Deer and Lethbridge are no longer being considered.
- Demand per capita has changed, to an average of 1.1 truckloads per 1,000 people. The population has increased considerably.
- The transportation cost has increased to \$2.5 per truck per km. This cost applies both for the trip from Edmonton to a demand location and the return trip from the demand location to Edmonton. Assume that that the truck follows the same route for the trip to the demand location and for the return trip.

The “Nodes” and “Arcs” worksheets provide the necessary network data. The “Arcs” worksheet lists each arc only once and the arcs are listed in random order. Use “Nodes” and “Arcs” worksheets to answer questions 2-5.

2. (1 pt.) What is the demand for Edmonton?
3. (1 pt.) What is the total demand for all of the nodes combined?
Hint: You may find the answer to this question useful in checking your solution for a later question.
4. (1 pt.) How much of the production capacity of Edmonton facility will not be needed, for satisfying the total demand in the network?
5. (2 pts.) Exploring the nodes and arcs:
 - a. Report the length of the shortest arc and the node numbers for the two nodes that are connected by the arc.
 - b. How many arcs touch Red Deer?

The “Red Dog” worksheet has the list of all nodes and all arcs for answering the following question. Note that arcs have been duplicated to allow flow in both directions. Use the “Red Dog” worksheet to answer Question 6.

6. (5 pts. for feasibility, 4 pts. for consistency, 2 pts. for optimality) Determine the least cost distribution plan for Red Dog using its current Edmonton production facility and current demand. Report the number of truckloads shipped along each arc in the network. Allow the demand at each node to be fractional. Allow the number of truckloads to be fractional, and report only arcs with non-zero shipments. You may not need all the cells provided in the “Answers” worksheet.

Report the total transport cost, the total production cost, and the total capital and operating cost.
Report the total number of truckloads produced in Edmonton.