OM 352, Fall 2023 **HW 5** **Assigned: 12 Oct. 2023**
Due: 11:59 PM, 18 Oct. 2023

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

Part 1: Mountain Wear Revisited (10 pts.)

The "MW" worksheet has a partially completed model for a modified version of the Mountain Wear case. The main modification is that the planning is done on a monthly rather than a quarterly basis. Assume that the formulas and given inputs (in bold green font) that have been entered are correct and note that some numbers are different from the Mountain Wear models you saw in the lecture and in the lab.

1. (2 pts.) If we use a level strategy for production, meaning that the Units Produced per month is fixed for the whole year, then what is the smallest whole number of Units Produced per month to satisfy forecasted demand in every month and to ensure safety stock constraint is met?
2. (4 pts. for feasibility, 3 pts. For consistency, 1 pt. for optimality) Find the optimal solution to the following problem. You will need to enter some missing formulas and you will need to enter the solver settings. Remember to set the integer tolerance to 0%.

Optimization problem: Minimize: Total Cost By changing: Units Produced, Number Hired, Number Laid Off, and Overtime Hours, for every month Subject to the following constraints, for every month: End-of-month inventory ≥ safety stock Number Hired and Number Laid Off should be integer Overtime Hours ≤ 10*(End-of-month number of employees) Total hours available (from regular and overtime) ≥ total hours needed for production

Report the values of the decision variables, the limit on overtime hours in Month 7, the total hours available in Month 2, and the total cost.

Note: *This is a difficult problem for solver as we have several integer constraints in the model. It is likely that solver takes between 1-2 minutes to find the optimal solution. At any time if you want to stop solver use ESC key.*

Part 2: Leduc Control Revisited (15 pts.)

Leduc Control has introduced a new product, the CG 508, to complement their two existing products, the AS 1012 and the HL 734. Also, they want to take into account the hours needed for quality tests of the product. So Quality Control has been added as a new resource to the problem. The Leduc worksheet shows the given inputs. The numerical values have been updated to reflect current conditions.

3. (3 pts.) Compute the variable cost per unit and the net margin per unit for all three products.
4. (3 pts. for feasibility, 2 pts. for consistency, 2 pts. for optimality) Use solver to find the number to make of each of the three products so as to maximize the total net. Allow the number to make to be fractional (for simplicity, and because we want to generate a sensitivity report, which is not possible if the model includes integer constraints). Report the number to make of each product, the total net margin, and the amount used from each resource.

The SR worksheet shows a sensitivity report for a correct version of a solver model to solve Question 4. Some numbers in the report have been removed. You should try generating a sensitivity report yourself and compare it to the one in the SR worksheet. If your model for Question 4 is correct, then your sensitivity report should have the same numerical values as the one in the SR worksheet. The row headings might be different, however.

Questions 5-7 are independent of each other. Some of them can be answered using the sensitivity report. For other questions, you may need to use other post-optimality approaches.

5. (1 pt.) What is the maximum amount we can increase the net margin per unit for the AS 1012 before the optimal production plan changes?
6. (2 pts.) Suppose that the number of available programming hours increases by 100. Does the optimal solution change? How much does the optimal total net margin change?
7. (2 pts.) Suppose that the number of available assembly hours decreases by 150. Does the optimal solution change? How much does the optimal total net margin change?