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

Homework Set 3

This assignment is worth 20 points, and is due NLT 1700 the day of Lesson 11. Late submissions will be penalized 1 point (5% of the assignment) for each 24-hour period late after the due time - with assignments turned in more than 7 days late receiving 0 points.

- **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 one pdf on Microsoft Teams. The pdf is this assignment with your responses, with the following naming convention:

  Section_LastName_FirstName_EM384_Homework_3

  Remember that engineering management is about communicating. You will be graded on the clarity and structure of your work.
- **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. **Solve a Linear Program Using the Graphical Method (8 Points)**

$$\textbf{minimize } Z = 15x_1 + 20x_2$$

subject to:

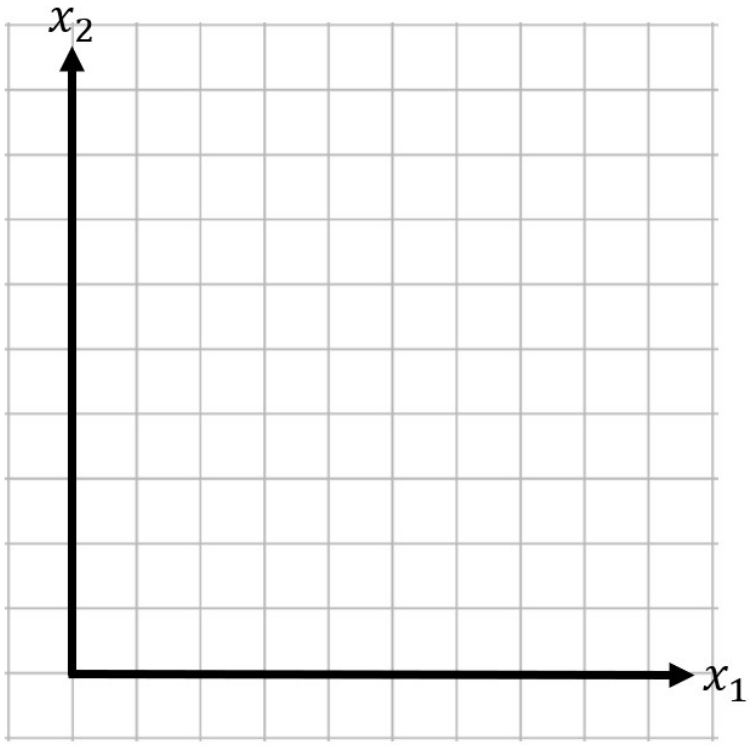
$$x_1 + 2x_2 \geq 10$$

$$2x_1 - 3x_2 \leq 6$$

$$x_1 + x_2 \geq 6$$

$$x_1, x_2 \geq 0$$

(a) **(4 Points)** Construct the axes and plot the constraints on a graph. Be sure to label your axes and label your lines. On your graph, circle all of the extreme points and shade in the feasible region.



(b) **(3 Points)** Solve for the value of the objective function at each of the extreme points.

(c) **(1 Point)** What optimal solution x_1^* and x_2^* minimizes the objective function?

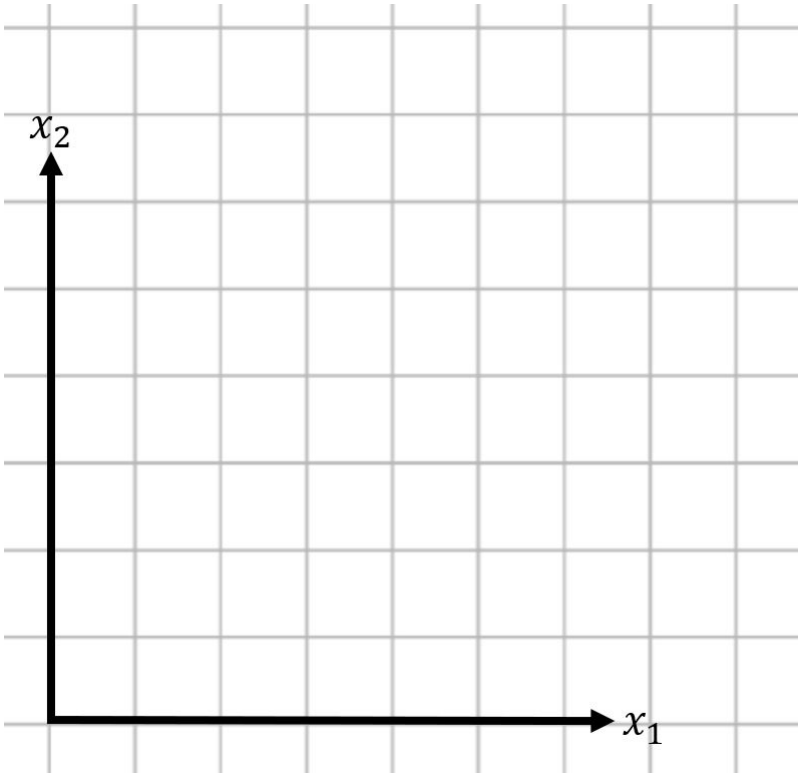
2. **Algebraically Formulate a Linear Program and solve Graphically (12 Points)**

An insurance company is introducing two new product lines: Special Risk Insurance and Mortgages. The expected profit is $100 per unit on Special Risk Insurance and $40 per unit on Mortgages. Management wishes to establish sales quotas for the new product lines to maximize total expected profit.

The Insurance company consists of three departments: Underwriting, Administration, and Claims. Each Special Risk Insurance product sold requires 3 work-hours in Underwriting and 2 work-hours in Claims. Each mortgage product sold requires 2 work-hours in Underwriting and 1 work-hour in Administration. The Underwriting department has 2,400 work-hours available, Administration has 600 work-hours available, and Claims has 1,200 work-hours available.

(a) **(5 Points)** Algebraically formulate the linear programming model for this problem. Clearly identify the Decision Variables, the Objective Function, and the Constraints.

(b) **(5 Points)** Construct a graphical solution for this problem. Plot all of the constraints, circle all of the extreme points, and shade in the feasible region.



(c) **(2 Points)** What is the optimal solution? Identify the values of the decision variables and the associated maximum value of the objective function.