

ORIE 5380, CS 5727: Optimization Methods
Homework Assignment 2
Due Friday September 25, 11:59am Eastern

Please submit a single PDF document formatted to print.

Question 1

Your company needs to source 1000 microwave ovens. You have solicited bids from 2 suppliers, A and B. Supplier A charges \$100 per microwave but is willing to give you a 10% discount on your entire order if you order at least 400 microwaves. Supplier B charges \$110 per microwave but is willing to give you a 20% discount on your entire order if you order at least 500 microwaves. Your company is wary of using a single supplier so you must order at least 200 microwaves from each supplier. Formulate the problem of selecting the number of microwaves to order from each supplier as a mixed integer program and solve it. (You can work out this problem by hand as a check if you like.) Hand in your formulation, code and solution.

Question 2

Sometimes you don't need integer variables to model piecewise linear functions in an optimization problem, as we'll see in this problem. You want to allocate 600 sales-agent hours (hours) to each of 3 regions, A, B and C so as to maximize sales. Sales in Region A are expected to be \$60 per hour up to 100 allocated hours and \$40 per hour for allocated hours in excess of 100. Similarly, sales in Region B are expected to be \$50 per hour up to 200 hours and \$45 per hour thereafter. Sales in Region C are expected to be \$55 per hour up to 200 hours and \$42 per hour thereafter. Formulate and solve this problem as a linear program. Do not use integer variables. Hint: You can rely on the properties of an optimal solution. Hand in your formulation, code, solution, and explain what it is about this problem that ensures you don't need integer variables.

Question 3

Formulate and solve the following "diabolical" Sudoku problem as an integer program. Hand in your formulation, code and solution.

	4					2	5	7
		5			7	4	6	
			4					9
1		2		4			8	
4				6				5
	6			9		7		1
2					6			
	7	1	5			6		
6	3	4					7	

Question 4

Consider the following problem, where the value of the input parameter A has not yet been ascertained. (Note: A is not a decision variable. It is a constant.)

$$\begin{array}{ll}\text{Max} & (\cos A) x_1 + (\sin A) x_2 \\ \text{s/t} & x_2 \leq 2 + x_1 \\ & x_2 \leq 5 \\ & x_1, x_2 \geq 0\end{array}$$

a) Plot the set of feasible solutions for this linear program.

b) Using the graphical method for solving linear programs, state the optimal solution to the linear program for all possible values of A ranging from 0 to 2 pi. Indicate the appropriate ranges for A that would render each one of these solutions optimal. If the problem is unbounded for some values of A then simply state “unbounded” for those. A complete answer lists a series of intervals for A and either states “unbounded” or gives a single point that is optimal for that interval. Your intervals should cover the interval from 0 to 2 pi.