Operations for Competitive Advantage
Homework 7
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5/8/13

1.

Let…

X_1 = the number of newspaper Ads placed
X_2 = the number of TV Ads placed

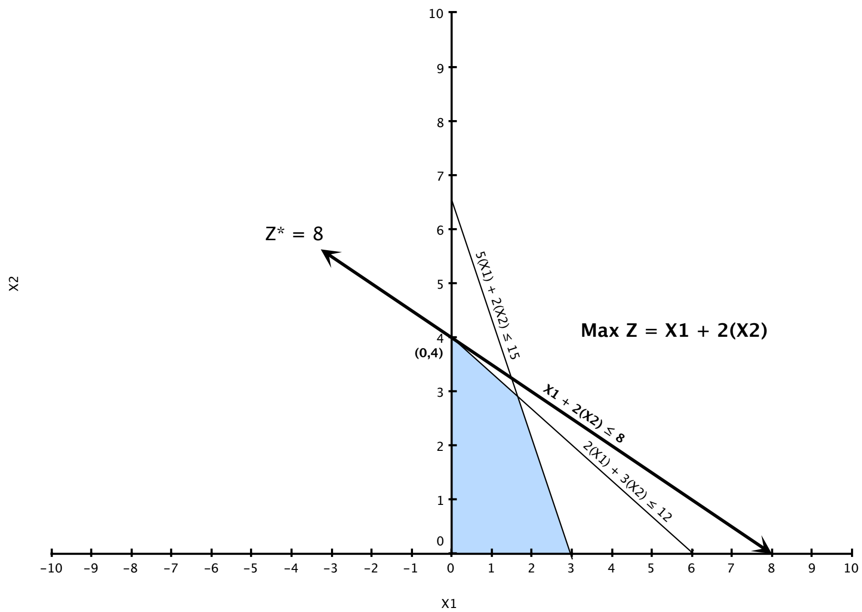
Constraints:

$X_1 \geq 5$	(Newspaper Ad requirement)
$X_1(0.04) + X_2(0.05) \geq 0.45$	(City Exposure requirement)
$X_1(0.03) + X_2(0.03) \geq 0.60$	(Suburb Exposure requirement)
$X_1, X_2 \geq 0$	(Non-negativity requirement)

Objective Function:

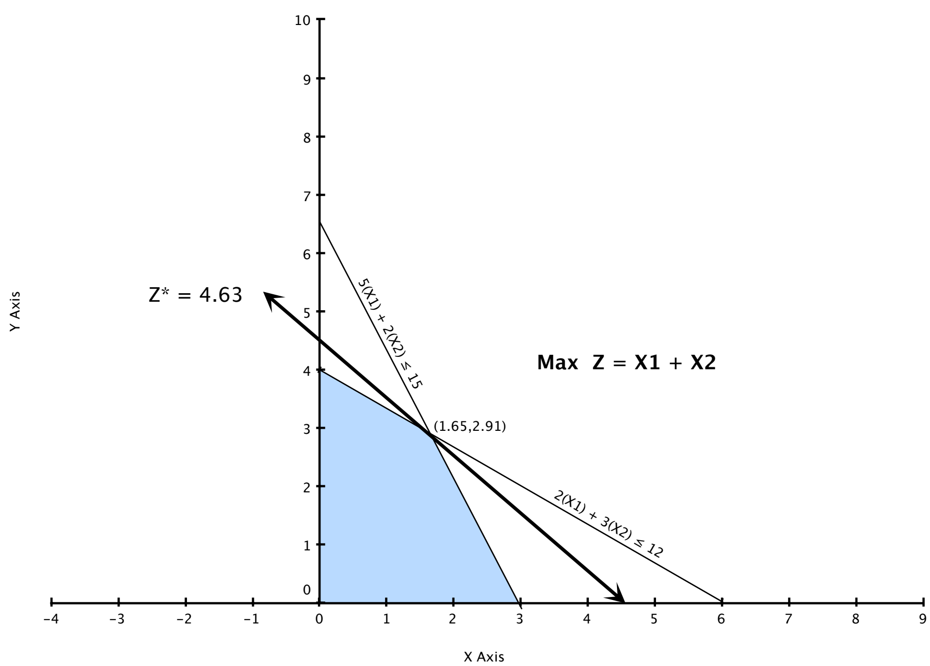
$Z = \$925X_1 + \$2000X_2$ (Minimize objective cost function)

Extra Credit Question



1.

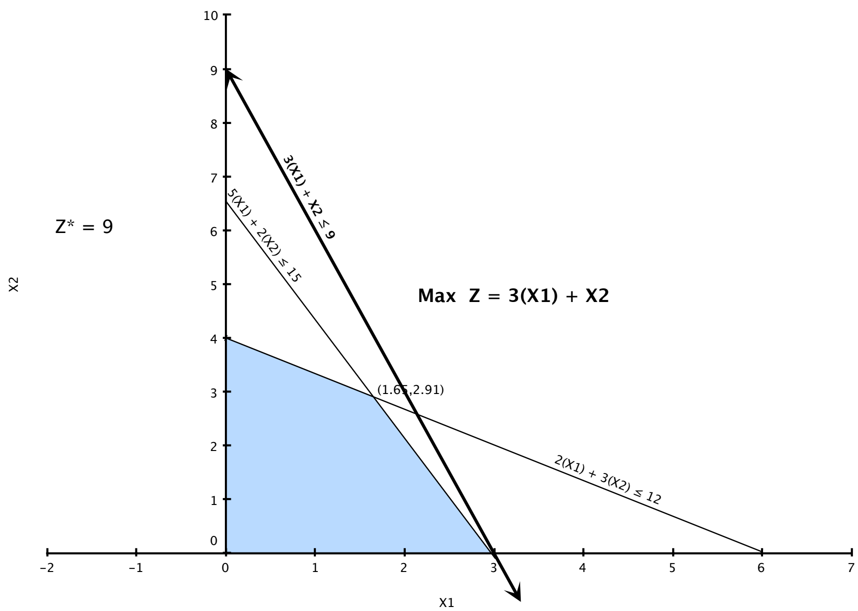
Z* = 8



2.

Z* = 4.63

3.

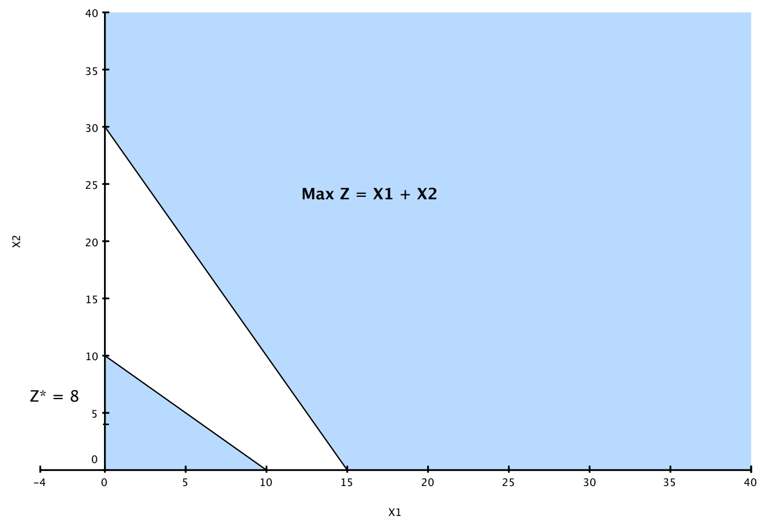


Z* = 9

The above three graphs all have the same constraints and thus the same feasible area, however each of their objective functions are different, which explains the different maximization points. The varying coefficients represent the profit contributions of each product (X1 and X2).

The reason each objective function has a different optimization point, is that the varying coefficients place a different emphasis on different products. When the coefficient for X1 is larger than X2, the optimization point gravitates towards the corner of the feasible area where X1 is larger and X2 is smaller since it will be more profitable to produce X1 than X2. This is true in question 3, in which the optimization point lies on the X1 axis (5,0) since the X1 coefficient is 3 and the X2 coefficient is 1. The opposite is also true when X2's coefficient is larger than X1, the optimization point shifts towards the feasible area where X2 is larger and X1 is smaller since X2 is now contributing more profit than X1. This happens in question 1, where X2 coefficient is 2 and X1's coefficient is 1 and thus the optimization point is (0,4). However, when both products contribute the same amount of profitability, as in question 2, the optimization point shifts towards a neutral corner (1.91,2.72) since both are important for profitability and neither contributes more than the other.

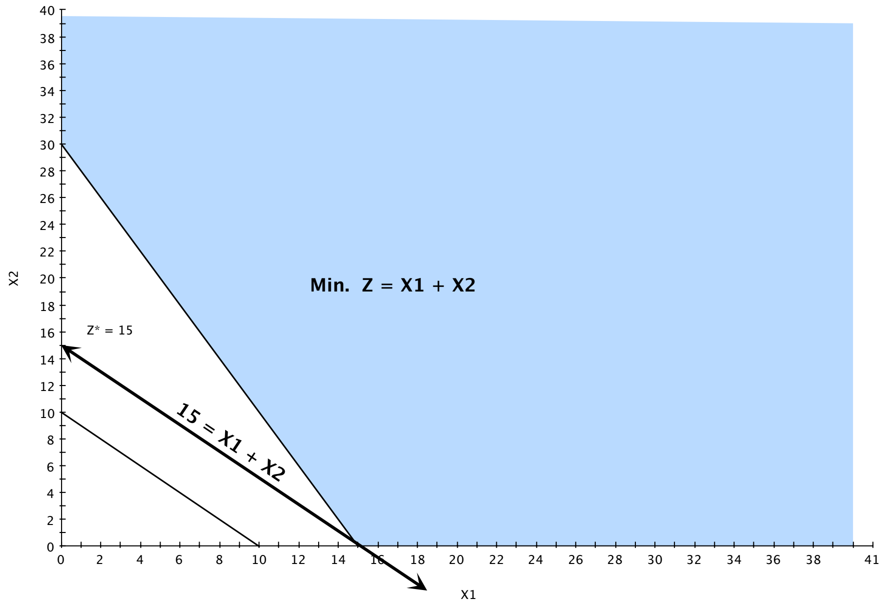
4.



Question 4 represents what is commonly referred to as a “unfeasible” problem since the constraints make it impossible to solve the equation using linear programming. The problem is that one restraint requires X1 and X2 to be below a line and another restraint requires X1 and X2 to be above a line with no overlap. Because of this, there is no point that satisfies all of the constraints and thus there is no “feasible” region making the problem unsolvable.

To describe this issue in production terms, I think it is best to give an example. This type of infeasible problem can occur if, for example, works are not allowed to work more than 10 hours a day, but a product requires at least 24 hours a day to produce. Because these constraints do not overlap, the production will be impossible and thus it cannot take place. While this is just an example, a more general explanation perhaps would be that two constraints do not overlap and thus production cannot occur, hence the name “infeasible”.

5.



Z*=15

Question 5 however has different constraints than 4 and thus does have an optimal solution at the point (15,0). There are two corners in the feasible region that could minimize the cost and since the constraining function (2(X1)+X2≥30) places more of an emphasis on X2's cost per unit, the optimizing point is when X2 contributes zero and X1 contributes 15 since it costs less to produce X1. Additionally, it should be noted that we are allowed to produce 0 units of X2 since apparently it is not necessary as the constraint functions show.