Golf Club Fertilizer problem

The problem we have chosen focuses on a person called chip green who is the head groundskeeper of a golfing club where he wants to determine the optimal price and amount of fertilizer to buy or whether or not he could buy several fertilizers and mix them together to obtain a 10-8-12 mixture at a lower cost than $21.75 per 100 pounds.

The problem in formal context:

Chip Green is the head groundskeeper at Birdie Valley Golf

Club. For the mix of grass for the golf course, Chip has decided

that the best fertilizer would be a 10-8-12 mixture.

(Fertilizer is defined by three values—*a*, *b* and *c*—where *a* is

the percentage of nitrogen, *b* is the percentage of phosphorus,

and *c* is the percentage of potash in the fertilizer. The

remaining material is inert matter.) Chip can buy a 10-8-12

mix of fertilizer for $21.75 per 100 pounds, but there are

other fertilizers on the market at a variety of prices.

The chemical content and prices are given below.

Chip would like to determine whether or not he could buy several fertilizers

and mix them together to obtain a 10-8-12 mixture at

a lower cost than $21.75 per 100 pounds.

Recognizing that it might be impossible to obtain an exact 10-8-12 mix from

the fertilizers, Chip is willing to accept chemical percentages

of at least the target amounts, but no more than 0.5% above

them (so the nitrogen level should be between 10% and

10.5%)

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| **Fertilizer** | **%Ni %Ph %Po** | **Cost/100 lb** |
| 1 | 10-8-12 | $21.75 |
| 2 | 8-11-15 | $23.50 |
| 3 | 12-7-12 | $22.00 |
| 4 | 10-10-10 | $19.50 |
| 5 | 15-10-6 | $18.50 |

The Linear Programming Model

We will be getting cost per pound so we will divide all out costs by 100 for our objective function.

Minimize z = 0.2175 *x*1 + 0.2350 *x*2 + 0.2200 *x*3

+ 0.1950 *x*4 + 0.1850 *x*5

Subject to:

10*x*1 + 8*x*2 + 12*x*3 + 10*x*4 + 15*x*5 ≥ 10,

10*x*1 + 8*x*2 + 12*x*3 + 10*x*4 + 15*x*5 ≤ 10.5,

8*x*1 + 11*x*2 + 7*x*3 + 10*x*4 + 10*x*5 ≥ 8,

8*x*1 + 11*x*2 + 7*x*3 + 10*x*4 + 10*x*5 ≤ 8.5,

12*x*1 + 15*x*2 + 12*x*3 + 10*x*4 + 6*x*5 ≥ 12,

12*x*1 + 15*x*2 + 12*x*3 + 10*x*4 + 6*x*5 ≤ 12.5,

*x*1 + *x*2 + *x*3 + *x*4 + *x*5 = 1,

*x*1, *x*2, *x*3, *x*4, *x*5 ≥ 0.