Q3

Question's data:
Max Revenue
W --> max weight that the crate can carry
V --> volume of crate
{(wi,vi,ci),…} -->
wi = amount that we have of item i (kg)
vi = density of item i (kg/liter)
ci = price of item i (dollar/kg)

** I'll assume V is in liters.

My solution:
Let xi be the weight (in kg) that we take from each item i.

Objective Function:
We want to maximize the revenue, so
Max z = x1*c1 + x2*c2 + ….. + xn*cn
This means that we are taking x1 kilograms of item 1, x2 kilograms of item 2,….,
and the revenue for item 1 will be x1*c1 $.

Constraints:
Now we have two weight constraints that we need to deal with:

1. The max weight that the crates can carry:
   To deal with this, the sum of the amount of the products we take has to be <= W. So
   x1 + x2 + … + xn <= W
   This means that we have to take xi kilograms or item i, then the sum of xi should be <= W.

2. The second weight constraint is from the amount of products we have, for each item i we have wi kilograms, so xi can't be more than wi for every i.
   x1 <= w1
   x2 <= w2
   ….
   xn <= wn

The other constrain that we have is related to the volume of the crate. The crate has a volume of V liters, and we have the density of our products, this means that the sum of the volumes of the items that we choose has to be <= V, so they fit into the crate. vi is the density of item i (kg/liters), so xi/vi will be the volume of item i that we choose.
x1/v1 + x2/v2 + … + xn/vn <= V

Finally the xi >= 0, for all i.

Final LP:
Let xi be the amount that we take from item i (in kilograms).

Max
z = x1*c1 + x2*c2 + ….. + xn*cn

Subject to:
x1 + x2 + … + xn <= W
xi <= wi
x1/v1 + x2/v2 + … + xn/vn <= V
xi >= 0
Where i goes from 1 to n