

Applications

I. Problems with unique solutions.

(a) A diet contains 3 foods: I, II, III to make a meal containing 44 units of vitamin A, 55 units of vitamin B, 48 units of vitamin C. The table below gives the vitamin content in units/ounce for each food.

How many ounces of each food should be in the meal?

Food	I	II	III
Vitamin A	1	2	3
Vitamin B	2	1	4
Vitamin C	2	5	1

Let x_1 = # ounces of food I

x_2 = # ounces of food II

x_3 = # ounces of food III

Set up a system of equations and solve!

(b) An American Company manufactures artillery shells (A), hand grenades (H), and bullets (B) from the raw materials gunpowder (G), lead (L), and steel (S). The materials are used as shown in percentage of weights in the following table.

%	A	H	B
G	60	50	50
L	10	10	20
S	30	40	30

The company will have a production run when the supply shipment arrives.

There are 2 possible shipments, given in 1000-pound units:

1. G – 140, L – 30, S – 100

2. G – 170, L – 50, S – 110

The company wants to use all materials on the production run. Find the production schedule (amounts of A, H, and B) for each supply possibility. Solve the 2 problems simultaneously.

(c) The Super Ball Company manufactures volleyballs (V_o), basketballs (B) and water polo balls (W) from the materials latex (L), nylon (N) and vinyl (V_i) as presented in the following table in ounces.

	V_o	B	W
L	4	7	2
N	1	2	1
V_i	2	5	5

The company will have a production run when the supply shipment arrives.

There are 2 possible shipments, given in ounces:

1. L – 325, N – 100, V_i – 300

2. L – 400, N – 150, V_i – 600

Find the production schedule (amounts of V_o , B and W) for each supply possibility. Solve the 2 problems simultaneously.

Applications

II. Problems with a parametric solutions.

(a) A man is ordered by his doctor to take 5 units of vitamin A, 13 units of vitamin B and 23 units of vitamin C each day. 3 brands of vitamin pills are available and the number of units of each vitamin per pill is shown in the table below.

Brand	Vitamin A	Vitamin B	Vitamin C
1	1	2	4
2	1	1	3
3	0	1	1

Find all combinations of pills that provide exactly the required amount of vitamins. Find the general solution and all possible particular solutions. If brands 1, 2, 3 cost 3¢, 2¢ and 5¢ per pill, respectively, what is the cheapest combination?

(b) Nutrine Feeds manufactures cat foods: MeowMix (M), CatChow (C) and CatTreats (T) from a blend of wheat and soybeans. A batch of M uses 1000 pounds of wheat and 3000 pounds of soybeans, a batch of C uses 2000 pounds of wheat and 7000 pounds of soybeans and a batch of T uses 2000 pounds of wheat and 5000 pound of soybeans. Assuming there are 15000 pounds of wheat and 50000 pounds of soybeans on hand, find the possible number of batches of each product that can be made such that all the available materials are used up.

(c) Diane wishes to invest \$32500 in 3 stocks, A, B, C. The costs per share are \$25, \$100, \$55 respectively and the dividend yields are \$1, \$2.40 and \$60 respectively. How should the stocks be invested to yield \$500 in dividends? Find the general solution and all particular solutions if there is an additional restriction that stock C must be bought in lots of 100 shares.

Answers

I. (a) (7, 5, 9) ; (b) (50, 190, 30) ; (50, 110, 170) in 1000 pound units ; (c) (25, 25, 25) , (50, 0, 100)

II. (a) $(8-t, t-3, t)$; $t \in [3, 8] \rightarrow t = 3$ then (5, 0, 3) ; $t = 4$ then (4, 1, 4) ; $t = 8$ then (0, 5, 8) etc.

Cost: $C(t) = 18+4t$ is smallest when t is least , i.e. $t = 3$

(b) (5, 5, 0) ; (1, 6, 1)

(c) $(\frac{9}{5}t - 700, 500 - t, t)$; $t \in [388.8\dots, 500]$; (20, 100, 400) ; (200, 0, 500)