## Algorithm template for Ex30: Fast-food and Health-food

Problem solving usually starts from manually solving a hand example (e.g., sample run). Note down all the steps (sub-problems) involved and then generalize it into your algorithm.

**Manual solving sample run #2**

```
Enter budget: $50
Enter fast-food cost per meal: $7
Enter health-food cost per meal: $3
Number of fast-food meals = 2
Number of health-food meals = 12
```

**Question 1**

What is the maximum number of health-food meals to take, given the budget in the above sample run?

50 / 3 = 16

**Question 2**

If we take the maximum number of health-food meals as in Question 1 above, how many fast-food meals at maximum can we take so that the total expense doesn't exceed budget?

0 fast-food meal to take since 16 health-food meals cost 48 dollars already (and each fast-food costs 7 dollars).

**Question 3**

If we take one less health-food meals than the maximum, how many fast-food meals at maximum can we take so that the total expense doesn't exceed budget?

Still 0 fast-food meal to take since 15 health-food meals cost 45 dollars already (and each fast-food costs 7 dollars).

**Question 4**

If we take one less health-food meals than in Question 3 above, how many fast-food meals at maximum can we take so that the total expense doesn't exceed budget?

1 fast-food meal (7 dollars) + 14 health-food meals (42); total cost is 49 dollars.

**Question 5**
If we take one less health-food meals than in Question 4 above, how many fast-food meals at maximum can we take so that the total expense doesn't exceed budget?

> 1 fast-food meal (7 dollars) + 13 health-food meals (39); total cost is 46 dollars.

**Question 6**
Now we tabularize our calculation.

| *Number of health-food meals* | *Cost of health-food meals* | *Maximum number of fast-food meals* | *Cost of fast-food meals* | *Total cost* |
|---|---|---|---|---|
| 16 | 48 | 0 | 0 | 48 |
| 15 | 45 | 0 | 0 | 45 |
| 14 | 42 | 1 | 7 | 49 |
| 13 | 39 | 1 | 7 | 46 |
| 12 | 36 | 2 | 14 | 50 |
| 11 | | | | |
| 10 | | | | |
| . . . | . . . | . . . | . . . | . . . |

**Question 7**
After some logically thinking, can you summarize the way to find the best combination of health-food meals and fast-food meals such that total cost doesn't exceed budget?

1. Engage a loop that starts with the maximum number of health-food meals, and in each round decrease the number of health-food meals by 1.

2. In each round of the loop:

   a. Compute (1) the maximum number of fast-food meals given the specified number of health-food meals and (2) the total expense in such a combination.

   b. If the total expense in this round is greater than the known maximum total expense, this round gives a better combination. Update the maximum total expense and note down the number of health-food meals and fast-food meals that give such a new maximum total expense.

   c. If the total expense exactly equals to the budget; we find the perfect combination and no need for further check.