

You have been advised by your doctor to get more exercise, specifically, to burn off at least 2000 extra calories per week by some combination of walking, jogging, swimming, exercise machine, collaborative indoor recreation, and pushing yourself away from the table at mealtimes. You have limited tolerance for each activity in hours/week; each expends a certain number of calories per hour, as shown below:

	Walking	Jogging	Swimming	Machine	Indoor	Pushback
Calories	100	200	300	150	300	500
Tolerance	5	2	3	3.5	3	0.5

How should you divide your exercising among these activities to minimize the amount of time you spend?

- 1) Write the optimization model to represent this problem. (submit Model.pdf)
- 2) Solve the problem using Excel Solver. Show the optimal solution and objective function value. (submit exercise.xlsx and answer1.pdf)
- 3) Suppose that you should also have some variety in your exercise — you must do at least one hour of each of the first four exercises, but no more than four hours total of walking, jogging, and exercise-machine.

Solve the problem using the AMPL.

(submit exercise.mod, exercise.dat, and answer2.pdf)

### ① Optimization Model

1. Decision Variable :

$x_i$  : the amount of time that spend on exercise type  $i$  <hour/week>

$$i = \begin{cases} 1 : \text{Walking} \\ 2 : \text{Jogging} \\ 3 : \text{Swimming} \\ 4 : \text{Machine} \\ 5 : \text{Indoor} \\ 6 : \text{Pushback} \end{cases}$$

2. Objective Function :

$$\text{MIN} : x_1 + x_2 + x_3 + x_4 + x_5 + x_6$$

3. Subject to :

$$100x_1 + 200x_2 + 300x_3 + 150x_4 + 300x_5 + 500x_6 \geq 2000$$

$$x_1 \leq 5$$

$$x_2 \leq 2$$

$$x_3 \leq 3$$

$$x_4 \leq 3.5$$

$$x_5 \leq 3$$

$$x_6 \leq 0.5$$

$$x_i \geq 0 \quad \forall i$$

$\therefore$  The minimize the amount of time that spend on the exercise is 6.33 hours/week to burn off at least 2000 extra calories per week.

- swimming : 3 hours/week
- indoor : 2.83 hours/week
- pushback : 0.5 hours/week

### ③ Optimization Model

1. Decision Variable :

$x_i$  : the amount of time that spend on exercise type  $i$  <hour/week>

$$i = \begin{cases} 1 : \text{Walking} \\ 2 : \text{Jogging} \\ 3 : \text{Swimming} \\ 4 : \text{Machine} \\ 5 : \text{Indoor} \\ 6 : \text{Pushback} \end{cases}$$

2. Objective Function :

$$\text{MIN} : x_1 + x_2 + x_3 + x_4 + x_5 + x_6$$

3. Subject to :

$$100x_1 + 200x_2 + 300x_3 + 150x_4 + 300x_5 + 500x_6 \geq 2000$$

$$x_1 \leq 5 \quad x_1 \geq 1$$

$$x_2 \leq 2 \quad x_2 \geq 1$$

$$x_3 \leq 3 \quad x_3 \geq 1$$

$$x_4 \leq 3.5 \quad x_4 \geq 1$$

$$x_5 \leq 3 \quad x_1 + x_2 + x_4 \leq 4$$

$$x_6 \leq 0.5$$

$$x_i \geq 0 \quad \forall i$$

$\therefore$  The minimize the amount of time that spend on the exercise is 7.83 hours/week to burn off at least 2000 extra calories per week.

- Walking : 1 hours/week
- Jogging : 1 hours/week
- Swimming : 3 hours/week
- Machine : 1 hours/week
- Indoor : 1.33 hours/week
- Pushback : 0.5 hours/week