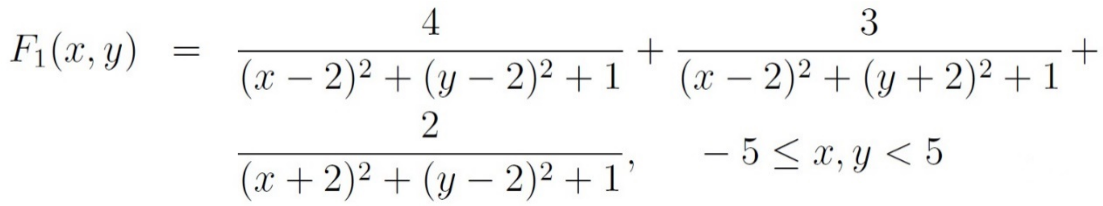
啓發式最佳化方法 作業 1

Q. Solve **hw-01.jpg** by any mean you come up with.



$$F_1(x,y) \;=\; \frac{4}{(x-2)^2+(y-2)^2+1}+\frac{3}{(x-2)^2+(y+2)^2+1}+ \\ \frac{2}{(x+2)^2+(y-2)^2+1}, \quad -5 \le x, y < 5$$

hw-01.jpg

Ans.

I write a python program to solve this problem. In my opinion, I cut the interval of x from -5 to +5 into n parts, and perform y as same as x. Then, I preform brute force algorithm to solve the question. Moreover, I control n to make sure it works in reasonable time, because I discover the program can't stop early when n is large. Finally, I get x = 1.993496748374187, y = 1.9884942471235618, and 4.294737864872209 is the max number of the below equation. My python code is shown in below page. Thanks for reading.

```
import numpy as np

def F1(x, y):
    a1 = 4/(pow(x-2, 2) + pow(y-2, 2) + 1)
    a2 = 3/(pow(x-2, 2) + pow(y+2, 2) + 1)
    a3 = 2/(pow(x+2, 2) + pow(y-2, 2) + 1)
    return a1 + a2 + a3

def BruteForce_RunAllF1(x, y):
    z = [] # record all output

    max_val = 0. # determinate the max value
    max_x = None # determinate the number x of the max value
    max_y = None # determinate the number y of the max value

    for i in x:
        for j in y:
            ans = F1(i, j)
            if max_val < ans:
                max_val = ans
                max_x = i
                max_y = j

    return (max_val, max_x, max_y)

n = 2000
x = np.linspace(-5, 5, n)
y = np.linspace(-5, 5, n)
(max_val, max_x, max_y) = BruteForce_RunAllF1(x, y)
print(max_x, max_y, max_val)
```