啓發式最佳化方法 作業 2

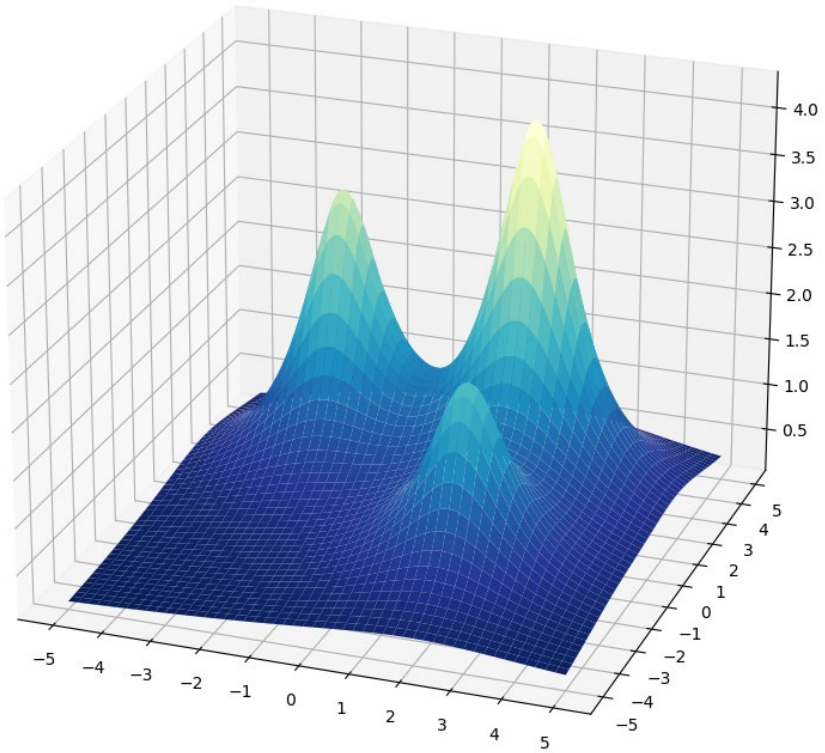
Q. Plot **hw-01.jpg** using any tool you preferred.

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

hw-01.jpg

Ans.

I write a python program to plot the 3D surface of the above equation. The 3D surface photo is shown as below. My python code is shown in below pages. Thanks for reading.



```
import numpy as np
import matplotlib.pyplot as plt
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:
        temp = []
        for j in y:
            ans = F1(i, j)

            if max_val < ans:
                max_val = ans
                max_x = i
                max_y = j

            temp.append(ans)
        z.append(temp)
    return (max_val, max_x, max_y), z

# control the slice number of data
n = 10000

# generate x-axis and y-axis
x = np.linspace(-5, 5, n)
y = np.linspace(-5, 5, n)

# generate the result that got using brute froce algorithm
(max_val, max_x, max_y), z = BruteForce_RunAllF1(x, y)
```

```
x_grid, y_grid = np.meshgrid(x, y)
z = np.array(z)

plt.rcParams["figure.figsize"] = (10, 10)
fig = plt.figure()


ax = fig.add_subplot(projection='3d')
ax.set_xticks(ticks=np.arange(-5, 6, 1))
ax.set_yticks(ticks=np.arange(-5, 6, 1))
ax.plot_surface(x_grid, y_grid, z, cmap=plt.cm.YlGnBu_r)
ax.view_init(elev=23, azim=-70)
plt.show()
```