

**ES 615 - Nature Inspired Computing**  
**Assignment 3**  
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**Portfolio Assignment using MOPSO**

Approach:-

1. First the given data is stored in arrays from the sheet
2. There are a total of 20 different stocks, hence the no. of weights for the portfolio assignment = no. of variables for PSO = 20
3. The weights are initialised with random values in range  $[0,1)$  and their sum is always maintained at 1
4. There are two cost functions - expected return, to be maximised and risk, to be minimised ; and two constraints as mentioned in the question
5. First of all the position of each of the particles is initialized with a random value and velocities are assigned zero
6. The pbest for each particle is same as the initial position and gbest is changed according to the dominance with the particles
7. Then at each iteration the position and velocity of each particle are updated according to the PSO rules and then constraints are applied to the positions and costs are evaluated
8. If these costs dominate the pbest or the gbest the values are updated respectively
9. Finally the particles undergo non-dominated sorting and the fronts obtained at each iteration are stored
10. After the final iteration is over the fronts for each iteration is plotted

**Interpretation of the final results:**

According to the MOPSO, the approx weights assigned for each of the 20 stocks to maximise expected return and minimize the risk is as follows:-

[0.06297197, 0.07099972, 0.01902789, 0.07136763, 0.0623618 , 0.00376848, 0.06289768, 0.06656532, 0.01449276, 0.01917789, 0.06082449, 0.05997604, 0.06984313, 0.06383996, 0.05661374, 0.07243916, 0.05777969, 0.00776028, 0.02927561, 0.06801577]

Optimum Expected Return and Risk - 4.961608626708837, 0.5378345348287976