NIC REPORT
Assignment 4: MOPSO

Parameter considered:

- **For return**, **weighted return** was used, which is given by:

  $$E = r_1*p_1 + r_2*p_2 + \ldots + r_n*p_n$$

  Where,

  r1, r2 and rn are the first, second and nth weights

  p_1, p_2 *and* p_n are the associated probabilities.

- **For risk**, **standard deviation of portfolio** was considered, Higher the standard deviation of portfolio, higher the risk.

Portfolio standard deviation for a two-asset portfolio is given by the following formula:

$$\sigma_P = (w_A^2\sigma_A^2 + w_B^2\sigma_B^2 + 2w_Aw_B\sigma_A\sigma_B\rho_{AB})^{1/2}$$

In case of three assets, the formula is:

$$\sigma_P = (w_A^2\sigma_A^2 + w_B^2\sigma_B^2 + w_C^2\sigma_C^2 + 2w_Aw_B\sigma_A\sigma_B\rho_{AB} + 2w_Bw_C\sigma_B\sigma_C\rho_{BC} + 2w_Aw_C\sigma_A\sigma_C\rho_{AC})^{1/2}$$

Where,

σ_P = is the portfolio standard deviation;
ω_B = weight of asset B in the portfolio;
σ_A = standard deviation of asset A;
σ_B = standard deviation of asset B; and
ρ_{AB} = correlation coefficient between returns on asset A and asset B.
ρ_{BC} = correlation coefficient between returns on asset B and asset C.
ρ_{CA} = correlation coefficient between returns on asset C and asset A.

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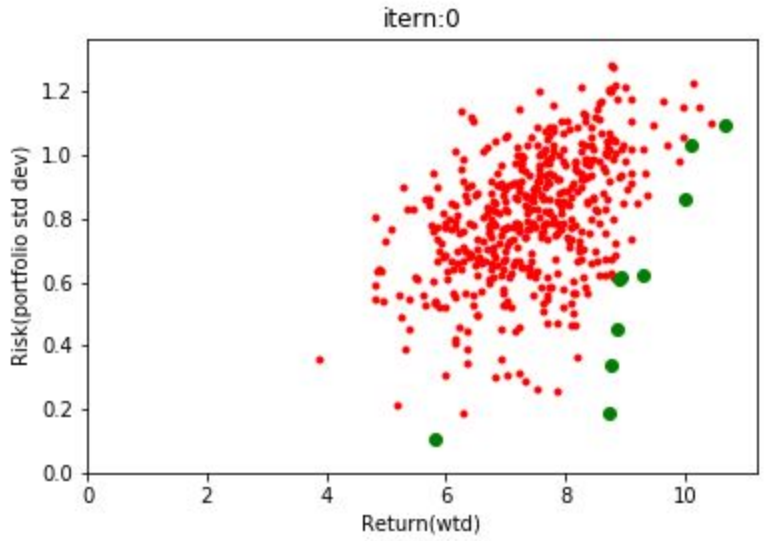
RESULTS

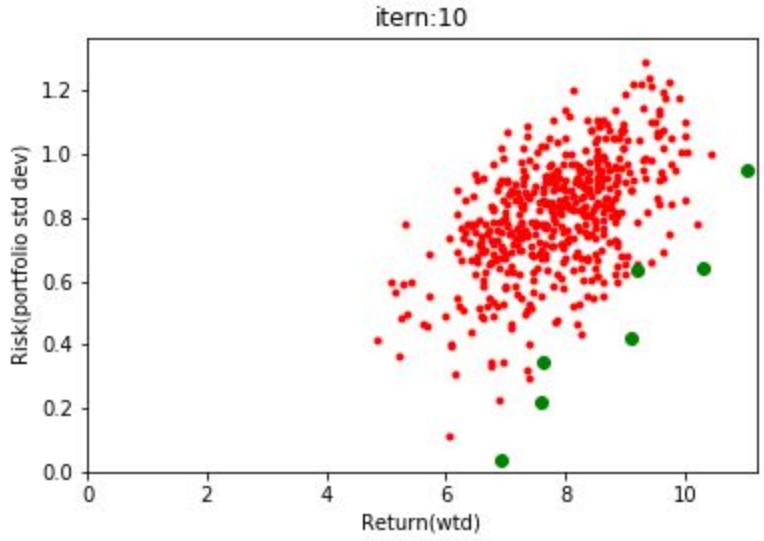
The pareto front that was obtained with multiple solutions.

At iteration = 0:



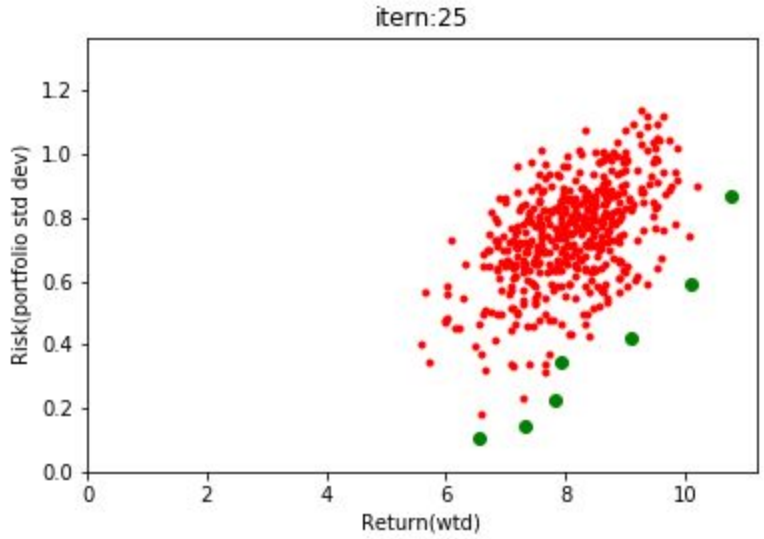
Initially, there was large variance in risk and return.

At iteration 10:



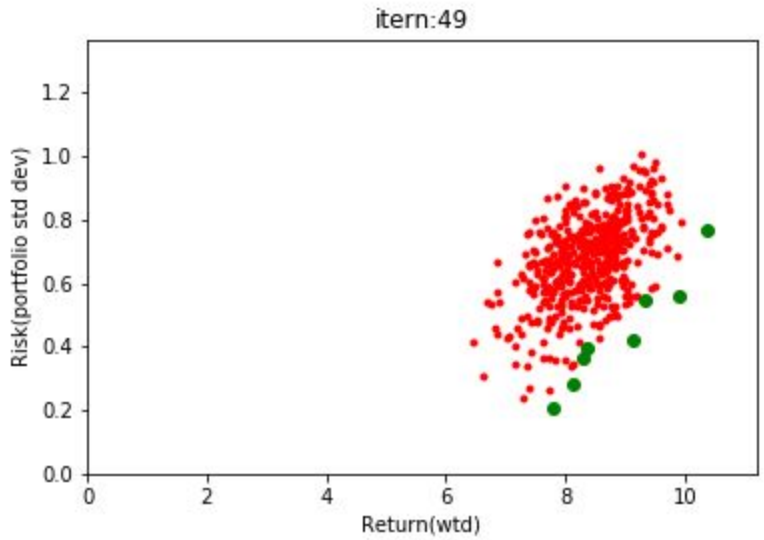
With increase in iteration, risk started to decrease.

At iteration = 25:



There is further gain in return and decrease in risk.

At iteration = 50:



There is a pareto front which is clearly visible with minimised risk and maximised return, which was our

goal. Initial iterations did not show this property. In case of initial iterations, both risk and return varied from High to low. However, with convergence of solution, risk has been moderated without affecting returns. However, if we continue to run the code for many more iterations, solution may converge to a small area.