Math 303 Report#3

1. Write Python subroutine, to implement the following 1D minimization algorithms:
   a) Fibonacci method.
   b) Golden section method.
   c) Newton's method.
   d) Quasi-Newton method.
   e) Secant method.

2. Using Python (or equivalent), implement the following algorithms for solving the unconstrained nonlinear optimization problem:
   a) Fletcher-Reeves CG Method.
   b) Marquardt Method.
   c) Quasi-Newton Method.

3. Utilize the above implemented algorithms to solve the following benchmark problems:
   a) **Rosenbrock**'s parabolic valley function starting from $\boldsymbol{X}_0 = (-1.2, 1.0)$

$$f(x_1, x_2) = 100(x_2 - x_1^2)^2 + (1 - x_1)^2$$

   b) **Powell's quartic** function starting from $\boldsymbol{X}_0 = (3.0, -1.0,\ 0.0,\ 1.0)$

$$f(x_1, x_2, x_3, x_4) = (x_1 + 10x_2)^2 + 5(x_3 - x_4)^2 + (x_2 - 2x_3)^4 + 10(x_1 - x_4)^4$$

   In your analysis, compare the above algorithms using the following criteria:

   a) Number of iterations.
   b) The optimal solution.
   c) The optimal value.
   d) CPU time.