

Department of Mathematics, IIT Madras

MA-5895-Numerical Optimization

Problem Sheet 2

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- Q. 1** Define a trust region algorithm. What are the key components for a trust region method. Define the parameter  $\rho_k$ , which gives a measure of the agreement between the model and the objective function  $f$ , and explain what different values of  $\rho_k$  imply about the approximate model under consideration.
- Q. 2** Write down an algorithm based on the value of  $\rho_k$ , which is the ratio of the actual reduction to that of predicted reduction, to determine a trust region radius. Explain in details the workings of the algorithm, thus proposed.
- Q. 3** Derive the Cauchy point  $p_k^c$  for a trust region method.
- Q. 4** Draw parallels between the trust region method with Cauchy point as the search step and the steepest descent method of the linear search methods. Based on the analogy drawn, comment about the convergence of the trust region method.
- Q. 5** Derive an optimisation problem which is equivalent to solving the following linear system of equation:

$$Ax = b. \tag{1}$$

Show that both the problems have one and the same solution.

- Q. 6** Discuss how preconditioning can affect the performance of conjugate gradient line search methods.