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**19th Summer School, University of Jyväskylä, Finland**
**SC2: Evolutionary Methods for Single and Multi-Objective Optimization**

**Assignment I: Optimization Basics**

Marks: 20

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1. Identify the optimum points of the following function: (6)
   (a) $f(x) = x^3 - 10x - 2x^2 + 10$.
   (b) $f(x_1, x_2) = x_1^2 + 2x_2^2 - 4x_1 - 2x_1x_2$.
2. Given the function:
   $$f(x_1, x_2) = 2 + (x_1^2 - x_2)^2 + x_2^2.$$
   Find the minimum point along the line joining the points $(-3, -4)^T$ and $(3, 2)^T$. (5)
3. Write down the Kuhn-Tucker conditions for the following problem:
   $$\text{Maximize} \quad 3x_1^2 - 2x_2$$
   subject to
   $$2x_1 + x_2 = 4,$$
   $$x_1^2 + x_2^2 \leq 19.4,$$
   $$x_1 \geq 0.$$
   Find out whether points $(0, 4)^T$ and $(3.4, -2.8)^T$ are Kuhn-Tucker points. Draw a neat sketch of the feasible region and mark the minimum point. (9)