Indian Institute of Technology, Kharagpur

Department of Mechanical Engineering

Date: ; Time: 2 hours; Full Marks: 30; No. of students:98

Autumn Sem. 2012-2013 (Mid. Sem.); Subject No.MF41601

B. Tech. and DD students; Subject Name: Soft Computing

Instructions: Answer all the questions. Assume suitable data, if necessary.

Marks:=13(9+4)+2+15=30 ; Marks: = 13 (9+4) + 2 + 15 = 30.

Q. 1

Minimize $f(x_1, x_2, x_3) = x_1 - x_2 + x_3 - x_1^2 + x_2^2 - x_3^2 + x_1x_2 - x_2x_3 + x_3x_1 + x_1x_2x_3$
subject to

$$-10.0 \leq x_1, x_2, x_3 \leq 10.0$$

(a) Use steepest descent method. Take the initial solution $X_1 = (x_1, x_2, x_3)^T = (0.0, 0.0, 0.0)^T$. Show only two iterations.

(b) To solve this minimization problem using a real-coded GA, let us assume that a mating pair is found to be as follows: $Pr_1 = 5.7$ and $Pr_2 = 3.8$.
Determine the children solutions using simulated binary crossover (SBX). Assume the probability distributions for the contracting and expanding zones as follows:

$$C(\alpha) = 0.5(q+1)\alpha^q,$$
$$Ex(\alpha) = 0.5(q+1)\frac{1}{\alpha^{(q+2)}},$$

where α is the spread factor and $q = 2$. Assume the random number $r = 0.4$.

Q. 2

Let us consider a TSP (scheduling) problem involving 10 cities:$A, B, C, D, E, F, G, H, I, J$. A scheduling GA with a **cycle crossover** assuming 5-th as the starting position (denoted by *) is to be used to solve the said problem. Determine children solutions of the following two parents:

$$Pr_1 : A\ B\ C\ D\ E^*\ F\ G\ H\ I\ J$$
$$Pr_2 : J\ A\ E\ H\ C^*\ B\ I\ F\ G\ D$$

Q. 3 Write short notes on

(a) Schema theorem of binary-coded GA

(b)Visualized Interactive GA (VIGA)

(c) Multi-Objective optimization and Vector Evaluated GA (VEGA)