Indian Institute of Technology, Kharagpur

Department of Mechanical Engineering

Date: ; Time: 2 hours: Full Marks: 30: No. of students:122

Autumn Sem. 2015-2016 (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:=18+3+9=30

Q. 1

Let us consider a constrained mixed-integer optimization problem of three variables: x_1, x_2 and x_3, as given below.

Minimize $f(x_1, x_2, x_3) = -x_1 + 2x_2 - x_3 + x_1^2 - 2x_2^2 + x_3^2$

subject to

$$x_1 + x_2 + x_3 \geq 520.00,$$
$$x_1 + 4x_2^2 + x_3^2 \leq 670.00.$$

and

$$0 \leq x_1 \leq 1023,$$
$$1.01 \leq x_2 \leq 11.25,$$
$$0.01 \leq x_3 \leq 5.13.$$

The real variables are assumed to have the precision level of 0.01. Use a binary-coded genetic algorithm (GA) to minimize the above function. Use a random population of size $N = 4$, tournament selection, two-point crossover with probability $p_c = 1.0$ and bitwise mutation of probability $p_m = 0.01$. Solve the above constrained optimization problem using the concept of static penalty (take penalty coefficient $C = 100.0$ for both the functional constraints, if they are found to be violated). Show only one iteration through hand calculations.

Q. 2

Let us consider a TSP problem involving 12 cities: $A, B, C, D, E, F, G, H, I, J, K, L$. A scheduling GA with Cycle Crossover is to be used to find the optimal schedule. Determine children solutions of the mating pair given below.

$$Pr\,1: \quad A\ C\ F\ B\ D\ J\ E\ K\ G\ L\ H\ I$$
$$Pr\,2: \quad B\ L\ E\ H\ J\ A\ F\ D\ K\ G\ I\ C$$

Assume $5 - th$ city counted from the left as the starting position of the cycle.

Q. 3 Write Short Notes on the following:

(i) Non-Dominated Sorting Genetic Algorithms (NSGA)

(ii) Random Walk Method of Optimization

(iii) Real-Coded Genetic Algorithms