

**ME674 SOFT COMPUTING
CODING ASSIGNMENT 2
REPORT**

**OPTIMIZATION USING BINARY CODED GENETIC
ALGORITHM**

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1. Problem statement:

Use a binary-coded GA to minimize the function $f(X_1, X_2) = X_1 + X_2 - 2X_1^2 - X_2^2 + X_1X_2$, in the range of $0.0 \leq X_1, X_2 \leq 0.5$. using a random population of size $N=6$, a single point crossover with probability $p_c=1.0$, and assume 5 bits for each variable.

2. Procedure for Binary Coded Genetic Algorithm:

- A population of size $N=6$ is randomly initialized containing 6 strings of length 10 bits. 5 bits for each variable
- Then decoded values s_1 and s_2 is then calculated.
- Then real values x_1 and x_2 are recalculated and fitness values are also calculated using following formula.

$$x_i = x_i^{(L)} + \frac{x_i^{(U)} - x_i^{(L)}}{2^{\ell_i} - 1} DV(s^i),$$

- Then the minimization problem is converted into maximization problem using fitness function of $F(X) = -f(x)$
- Then reproduction is carried out through tournament selection of size 3 and winners are obtained from reproduction.
- Then for Crossover, Elitism method is used in which best 2 solutions are kept same and Single Point Crossover method is carried out for 4 remaining solutions with probability of $p_c=1.0$.
- Then Mutation is carried out over the population with mutation probability of $p_m=0.05$.
- Then this process is carried out for 10000 generations.

3. Results

After 10000 number of generations the population obtained is as follows:

- 0 0 0 0 0 0 0 0 0 0
- 0 1 0 0 1 0 0 0 1 0
- 0 0 0 1 1 0 0 0 1 0
- 1 0 0 1 1 0 0 1 1 0
- 0 0 0 0 1 0 0 0 1 0
- 0 1 0 1 0 0 0 0 1 0

- The final x1,x2 and fitness values are as follows:

Sr. No.	X1	X2	Fitness Value
1	0.000000	0.00000	0.00000
2	0.016129	0.00000	-0.015609
3	0.000000	0.00000	0.00000
4	0.016129	0.00000	-0.015609
5	0.016129	0.00000	-0.015609
6	0.016129	0.00000	-0.015609

Final Solution:

X1 = 0.00000

X2 = 0.00000

=====x=====