Genetic Algorithm

Take Home Sums

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1. Optimize the function $y = x^2 + 5$ in the domain $-40 \leq x \leq 40$ using GA. Take the number of individuals in the population as 10. Represent the individuals using binary strings of 4 bits each. Take the probability of cross over as 0.9 and the probability of mutation as 0.01. Carry out the procedure for 10 generations. Plot the y vs generation number.

2. Find the optimized length, height and breadth of a cuboid having minimal volume and maximum surface area. The range of the dimensions are 0.1cm to 2cm using GA. Choose the population size as 10. Use 3 binary bits to represent the individuals. Take the cross over probability as 0.9 and the mutation probability as 0.05. Carry out the procedure until you get a convergence of epsilon ≤ 0.1. (Hint: epsilon = length in current generation − length in previous generation.)

3. When a critically damped RLC circuit is connected to a voltage source, the current I in the circuit varies with time according to the equation

$$I = \left(\frac{V}{L}\right) t e^{-Rt/2L}$$

Where, V is the applied voltage, L is the inductance, and R is the resistance (all of which are constant).
Suppose an RLC circuit with a resistance of 30.0 volt/amp and an inductance of 0.400 volt·sec/amp is attached to a 12.0-volt voltage source. Find the maximum current that will occur in the circuit.

4. You have 1000 meters of fencing material available. Find the sides of the rectangular field having maximum area which you can fence.

5. Your company owns an apartment complex having 400 currently filled apartments. The current monthly rent per apartment is Rs.4000. Your company is planning to increase the rent per month. Market research shows that for each increase in Rs.200, you will lose 10 tenants. Formulate the problem and solve using GA to find the optimal increase in rent and the maximum revenue the complex can make.

6. You are a builder who has been entrusted to build an office building. It is estimated that the cost of constructing an office building that is n floors high is $c(n) = 3n^2 + 5400n + 75000$ thousand rupees. Find the minimum number of floors that you should construct so that the average cost per floor is minimum. Also find the cost of this building.