

# Genetic Algorithms and Fuzzy Logic

## TAE – 1

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**Problem Statement:** Given a rod of length  $L$  and you have to cut it into a number of maximum  $n$  pieces. The cost  $c_i$  of a piece  $p_i$  of length  $l_i$  is given.

Length	$l_1$	$l_2$	$l_3$	$\dots$	$l_m$
Cost	$c_1$	$c_2$	$c_3$	$\dots$	$c_m$

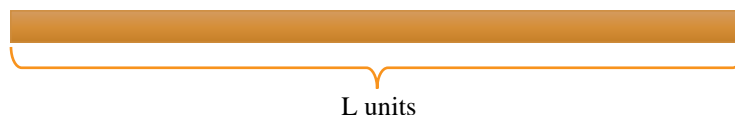
You have to cut the rod into a number of pieces so that the cost of cut ensembles is maximum.

With respect to the above problem, answer the following questions.

- It is proposed to solve the problem using binary coded GA. State the genotype of the chromosome to be followed.
- State a criterion to evaluate the fitness of an individual.

**Answer:**

Suppose we have a rod of length  $L$ ,



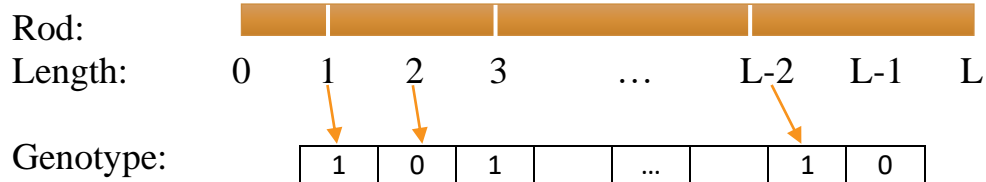
And we can cut it in multiple pieces ( $< n$ ), our task is to maximize the total cost of pieces of rods.

### a) Binary Encoding

In binary encoding every chromosome is a string of bits, 0 or 1.

Let's assume that the rod can be cut in integer units only (e.g., 1m, 10m).

The position where the rod is cut into pieces are marked as 1 and others as 0.



### b) Fitness Function

The fitness function simply defined is a function which takes a candidate solution to the problem as input and produces as output how “fit” or how “good” the solution is with respect to the problem in consideration.

In the given problem,

We have to maximize the cost. And we are also given that the rod can be cut into maximum  $n$  pieces.

Therefore, the fitness function must take into account the **cost of pieces** of rod and **number of pieces**.

The final fitness value will be the sum of cost of pieces of the rod.