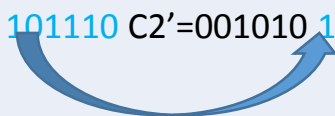# Genetic Algorithm(GA)

We can represent the solutions of many problems by a sequence. GA can be used to find approximate solutions for them using limited amount of time. If we need an exact/perfect solution (not an approximate one that serves our purpose), then GA is not the right algorithm.

Example steps of simplified GA are:

Steps	Example
1. Randomly generate few solutions (genes)	A=001110101000, B=101100111010, C=001010101111, D=100010101001
2. Check which of them is the best and select it	Lets assume, C=001010101111 is the best
3. If the selected gene offers acceptable solution TERMINATE the algorithm, else, name the selected gene as "C" and CREATE two new genes C1 and C2 from C by flipping one or more bits (in C) from 1 to 0 or 0 to 1; this operation is known as mutation	From C=001010101111 we can find the following using mutation C1=101010101111 (1st bit mutated) and C2=001010101110 (last bit mutated)
4. (a) If both of the new genes (C1 and C2) are better than C , then swap equal-length segments between them; this operation is known as cross-over Select the best among C1, C2, C1' and C2' and go to Step 3	(a) C1'=101010 101110 C2'=001010 101111 (the last 6 bits are swapped)
4(b) If one of the new genes is better than C and other is not, then select the better one and go to step 3.	
4(c) If none of the new genes are better than C, then C is still the selected gene. Go to step 3.	

Assignment 1.a.

A company has 10 experts. They make yes/no decisions and majority voting is used to make the final decision (i.e., if more THAN 50% members make the same decision, that decision is the final decision). If the voting is "50%" yes and 50% "no", then "yes" is the final decision. The history of the correct(c)/incorrect(i) decisions made by these experts for last five decisions are presented below. Use genetic algorithm to select a subset of these experts that the company should retain (and fire the rest) to make overall correct decisions at least in 80% cases.

You can write a program or use Excel or do manually.

	Decision1	Decision2	Decision3	Decision4	Decision5
Expert 1	I	I	I	C	C
Expert 2	I	I	I	I	I
Expert 3	C	C	C	C	C
Expert 4	I	I	I	I	I
Expert 5	I	C	C	C	C
Expert 6	C	C	I	I	C
Expert 7	I	C	I	C	I
Expert 8	I	C	C	C	C
Expert 9	C	I	I	I	C
Expert 10	C	C	C	C	I

Hints: Begin with several random 10 bit genes such as 1101110101. A "1" in n^{th} position indicates that n-th expert is hired and a "1" in n^{th} position indicates that n-th expert is fired. To determine how good a solution is, check, in how many cases that solution provides a correct majority voting decision.

Assignment 1.b

A company plans to buy lead-test kits. Two different suppliers provided 100 sample test kits (each) for evaluation. The results are listed in the following table:

Supplier A	43 out of 70 lead surface were identified as containing lead	30 out of 30 non-lead surface were identified as not containing lead
Supplier B	48 out of 70 lead surface were identified as containing lead	25 out of 30 non-lead surface were identified as not containing lead

Compute confusion matrix for them. In your opinion, which supplier should get the job? Why?