

## CHAPTER 5 GENETIC ALGORITHM

01. Let  $G$  be the current generation of individuals
02. Create a probability distribution based on  $G$ . Let  $T$  be the set of all genotypes in  $G$  and define  $\text{Pr}(T)$  as

$$\text{Pr}(t) = \frac{f(t)}{\sum_{t_0 \in T} f(t_0)}$$

Where  $f(t)$  denotes the fitness of an individual of genotype  $t$ .

03. Let  $G'$  be initially empty.
04. For  $i = 1$  to  $|G|/2$ 
  - i. Randomly choose two parents  $p$  and  $p'$  according to  $\text{Pr}(T)$  (reproduction).
  - ii. Randomly swap bits in  $p$  and  $p'$  to obtain two new individuals (crossover).
  - iii. Mutate the new individuals by randomly flipping a small number of bits and add the resulting individuals to the new generation  $G'$  (mutation).
05. Return  $G'$

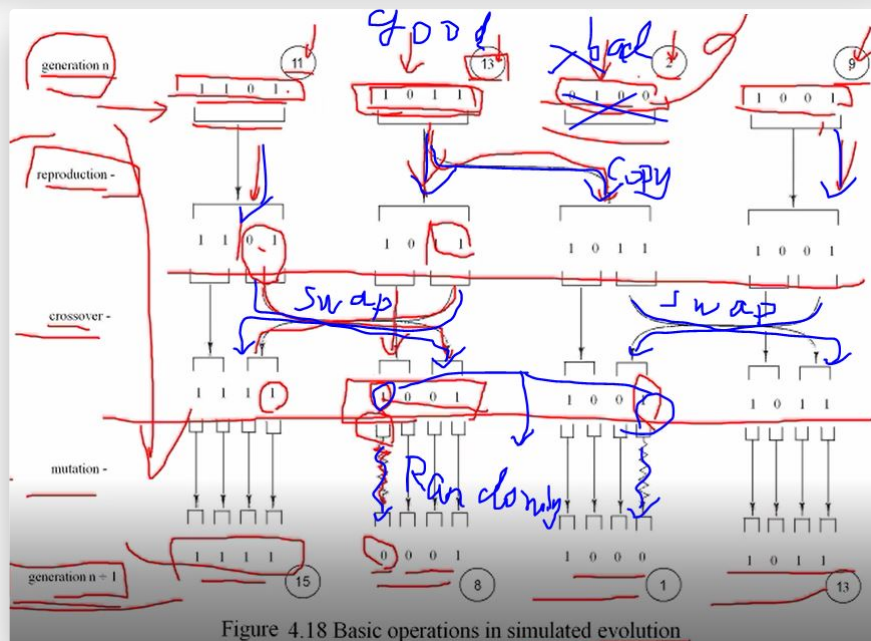
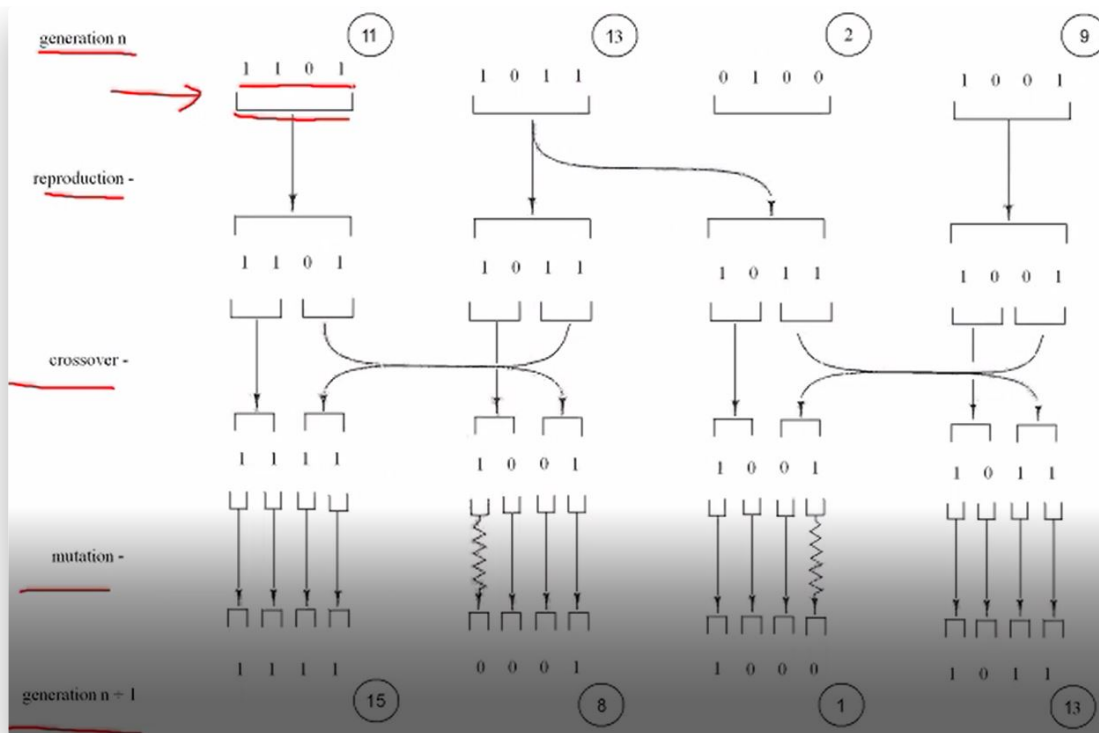


Figure 4.18 Basic operations in simulated evolution

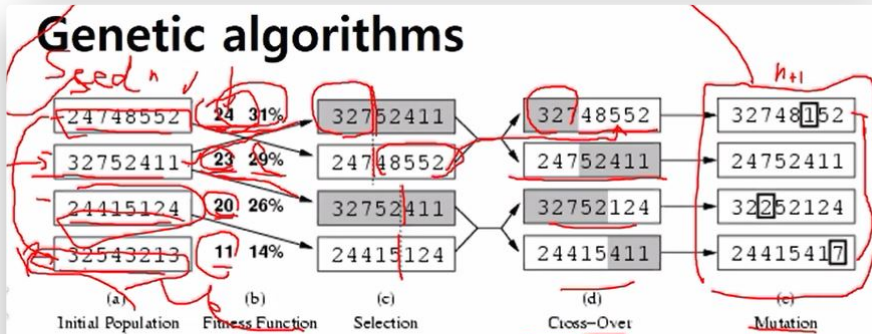
- A successor state is generated by combining two parent states
- Start with k randomly generated states (**population**)
- A state is represented as a string over a finite alphabet (often a string of 0s and 1s)
- Evaluation function ( **fitness function** )
- Produce the next generation of states by selection, crossover, and mutation

# Genetic algorithms



- Fitness function: number of non-attacking pairs of queens  
(min = 0, max =  $8 \times 7/2 = 28$ )
- Dominant gene, Recessive gene
- $24/(24+23+20+11) = 31\%$
- $23/(24+23+20+11) = 29\%$  etc

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