Artificial Intelligence Fundamentals
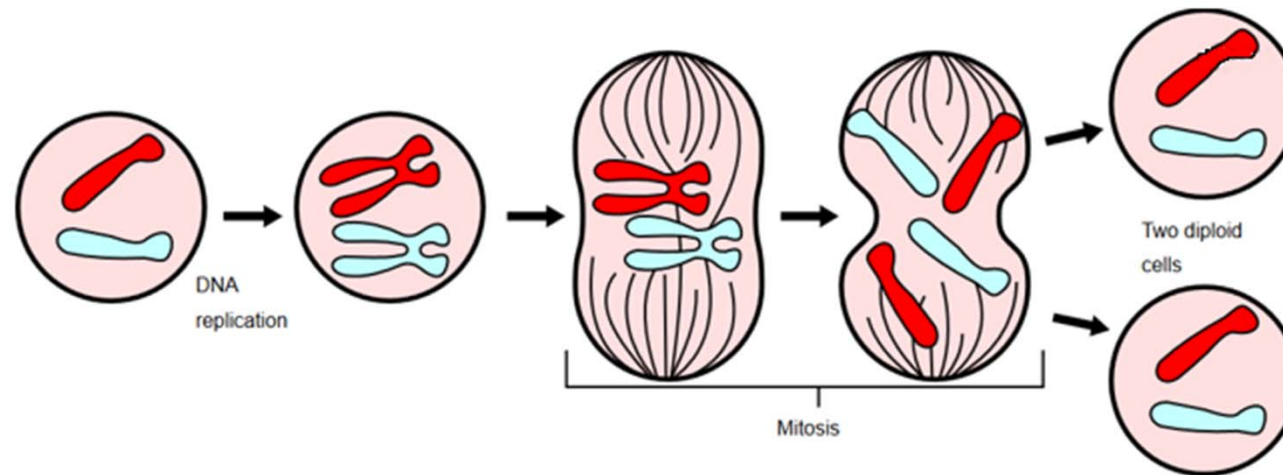
Learning: Genetic Algorithms

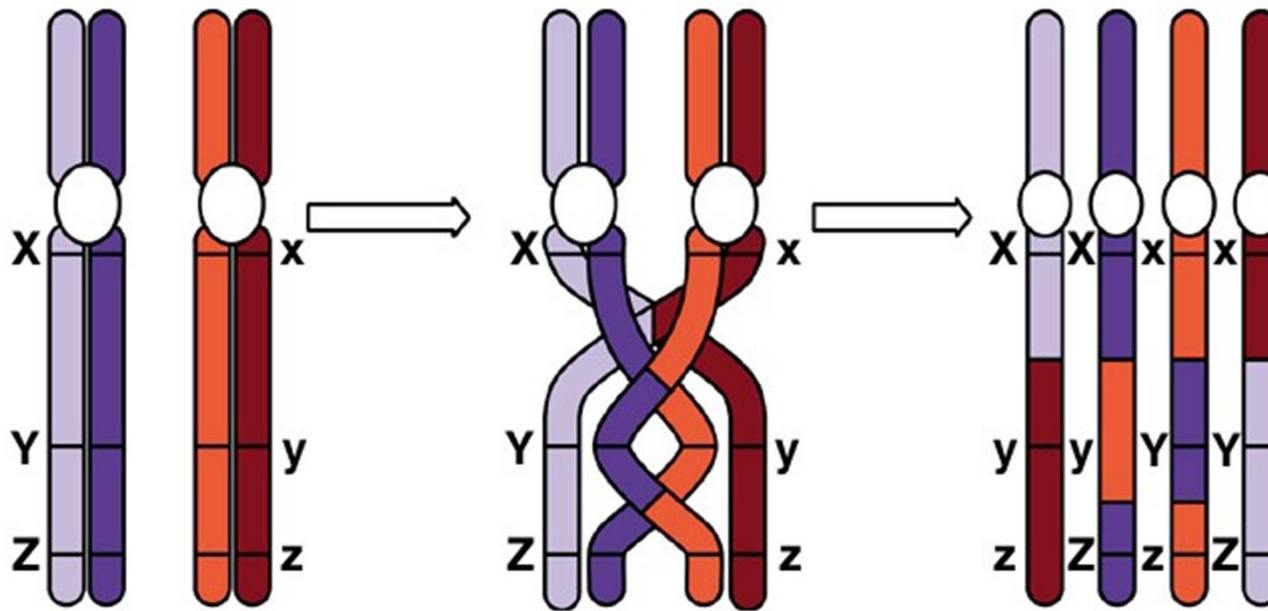# Mitosis

- Process when new cells are generated

Chromosome number	46	46	46	46
Chromatid number	46	92	92	46

Reproduction

- Meiosis - Special type of cell division that occurs in sexually reproducing organisms

Chromosome - mutation

.....0110001000100.....   A string of things

Population ⟶ **Mutation**

.....0110001000100.....   .....0110101000100.....

.....0111010101100.....   .....0111011101100.....

.....1110110111100.....   .....1110110111100.....
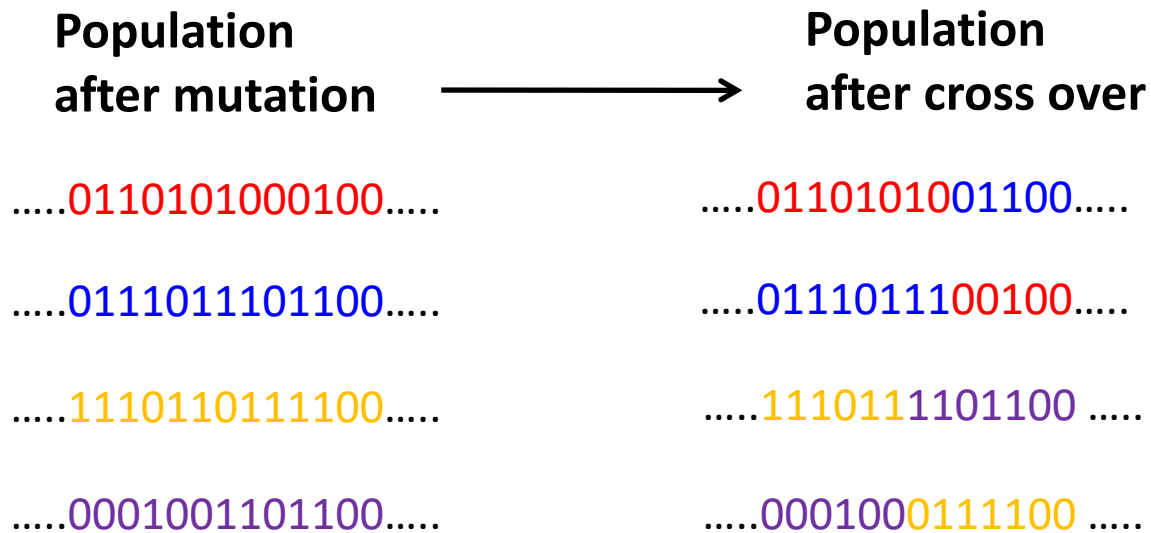
.....0001001101100.....   .....0101001101100.....

Parameters – how many mutations per chromosome ; how many chromosome we allow to be mutated?

Chromosome – cross over

**Population
after mutation** ⟶ **Population
after cross over**

…..0110101000100….. …..0110101001100…..

…..0111011101100….. …..0111011100100…..

…..1110110111100….. …..1110111101100 …..

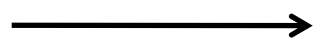…..0001001101100….. …..0001000111100 …..

Parameters – how many cross over operations per chromosome ;?

Chromosome - genotype to phenotype transition

- The chromosome must be interpreted in order to be something

- Each chromosome create an individual

Population after cross over ⟶ **Individuals** ⟶ **Fitness**

…..0110101001100…..   64

…..0111011100100…..   12

…..1110111101100 …..   56

…..0001000111100 …..   112

Fitness – Probability - Selection

Fitness	→	Probability	→	Selection phenotype to genotype
64		0.44		…..0111111000100…..
12		0.07		…..0111010101100…..
56		0.56		…..0001110001100…..
112		0.82		…..1010001000100…..

Selection methods

1. Based on fitness

$$P_i = \dfrac{f_i}{\displaystyle\sum_j f_j}$$

2. Rank space

$$P_1 = p_c \qquad\qquad P_3 = (1-p_c)^2\, p_c \qquad\qquad P_{N-1} = (1-p_c)^{N-2}\, p_c$$

$$P_2 = (1-p_c)\,p_c \qquad\qquad \text{........} \qquad\qquad P_N = (1-p_c)^{N-1}$$

3. Fitness and diversity rank

diversity

fitness
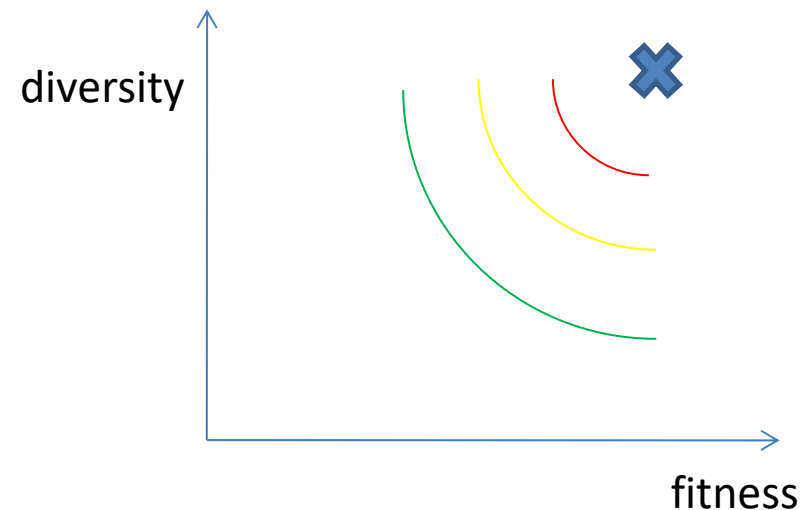
Planning problems

- S_1 , S_2 , S_3 ... S_n
- S_1 , S_2 , S_3 ... S_n

- S_1 , S_2 , S_3 ... S_n

Rule based problems

- IF X and Y THEN .....
- IF A and B THEN .....

- IF X' AND M THEN .....   X'- mutated X

Related resources

Readings

- Artificial Intelligence (3rd Edition), Patrick Winston, Chapter 25