

Genetic Algorithms

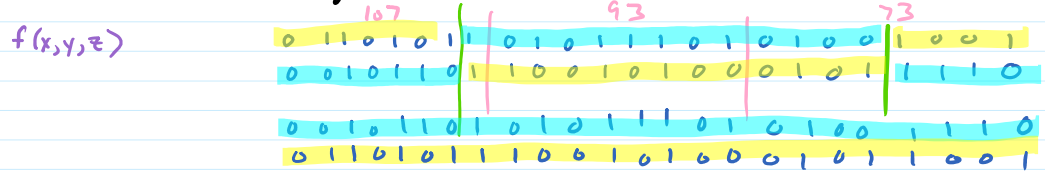


mimic natural selection
 individuals have genes
 genes determine phenotype
 phenotype contributes to fitness
 fitness contributes to propagation

nature-inspired
 - Ant Colony Optimization
 - Particle Swarm Opt

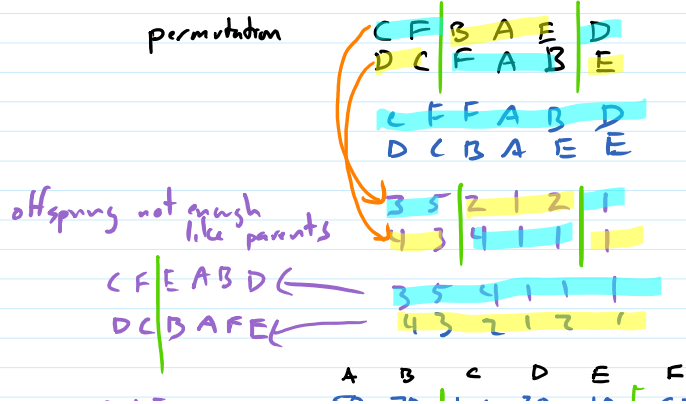
- start with random population - collection of individuals w/ random genes
- while not done (out of time, no improvement, good enough...)
- evaluate each individual genes \rightarrow inputs to $f \rightarrow$ evaluate $f \rightarrow$ fitness
- select for crossover select pairs of individuals, biased towards higher fitness
- crossover randomly select genes from parents to produce offspring
- select for survival replacement fitness-based
- mutate randomly change genes in some individuals (generally low rate)

Representation: what is genetic code?



Crossover: bitstrings ex: two-point crossover

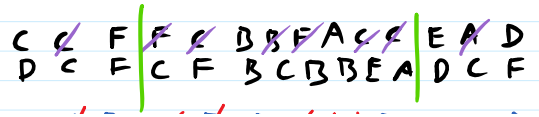
0111010
1101100



not a valid input!
 also not a permutation! infeasible

solutions

- assign low fitness to infeasible solns
- design genome to avoid infeasible offspring



DCDAFE ← 4 3 2 1 2 1

CFBADE
 DCFABE
 FDBCAE

	A	B	C	D	E	F
←	50	70	100	20	10	80
←	32	30	50	75	26	40
	50	70	50	75	26	80

~~C~~ ~~C~~ ~~F~~ ~~F~~ ~~B~~ ~~B~~ ~~F~~ ~~A~~ ~~C~~ ~~C~~ | E A D
 D C F C F B C B B E A D C F
~~C~~ ~~C~~ ~~F~~ ~~F~~ ~~B~~ ~~B~~ ~~F~~ ~~A~~ ~~C~~ ~~C~~ | E A D
 ↳ phenol type
 CFBEAD