Optimization
Given a function $f\left(x_{1}, \ldots, x_{n}\right)$, find values of $x_{1}, \ldots, x_{n}$ to minimize/maximize $f$
find $x, y$ to marimize $4 x+5 y-2 x y-x^{2}-y^{2}$
Sind ordenng of Seattle, Denver, Allentown, Baltimore, Amherst, Washington to minimize distance of corresponding tour
find assignment of classrooms to minimize student conflicts find ordering of teams to minimize upsets during previous seas on


WACBH

Solitaire Yahtzee: Estimate start-of-turn position value by counting
estimates of value of inch category

$$
\left.\begin{array}{rl}
f\left(x_{1}, \ldots, x_{13}\right.
\end{array}\right)
$$

$\left(\begin{array}{c|ccc}3 & \text { for } \\ 6 & \text { for } & \text { 2's open } \\ \vdots \\ 18 & & \\ \text { for } & \text { 6's open }\end{array}\right.$
+6 /peen upper if on pace or bonus
20 for open 3 of a land
10
15 for FH
10 ' Lo r Yahtzee

Play each turn to maximize turn score + next position value using heunzble Find parameters to maximize arg. score



Genetic Algonthms
mimic natural selection nature-Anspired - ant colony opt max $f(x, y, z) \longleftarrow \quad$ Individuals have genes $\begin{aligned} & \text { genes determine phenotype (physical charactenstics) }\end{aligned}$ genes determine phenotype fiphysical Sines contributes to propagation
start with random population - random collection of individuals While not dome (out Population no recent improvement) (random genes)
evaluate individuals genes $\rightarrow$ inputs to $f \rightarrow$ evaluate $f \rightarrow$ fitness generation select for crossover bias boards individuals y linger fitness
crossover randomly select genes from ouch parent bor offspring select for survival replacement? (offspring replace pariahs) fitness based? Left spins (Compote parents) mutate

Representation: what is genetic code? Some sequence of $b, \frac{1}{3}$


