CSE/ECE 848 Introduction to Evolutionary Computation

Module 2, Lecture 8, Part 4d
More Theory—More Practical Training

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A Question of Efficiency: Crossover Between Similar Individuals

As search progresses, more individuals tend to resemble each other

When two similar individuals are crossed, many choices of crossover points yield exactly the same results in the offspring, but some offspring are much more likely to be created--not a good thing, we get lots of copies of those children

Can counter this with "reduced surrogate" crossover (1-pt, 2-pt):

Reduced Surrogate Crossover (Lashon Booker, 1987)

Given: 000111011010011 and

000100l010010010, drop all *matching* positions, getting:

----11---1-----1 and

----00---0-----0, are two "*reduced surrogates*"

If pick crossover pts IGNORING DASHES, 1-pt, 2-pt still search similarly to uniform

They make ALL points that would have *different effects* be equally likely

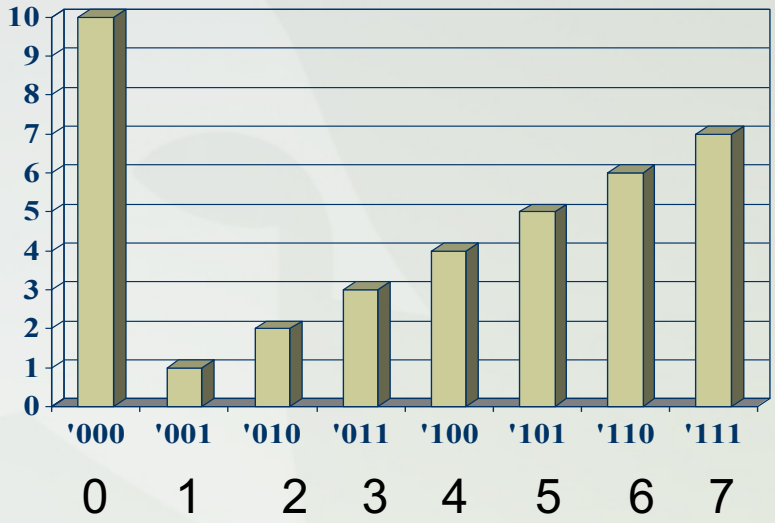
What are Common Problems When Using GAs in Practice?

- Hitchhiking: BB1.BB2.junk.BB3.BB4: the junk adjacent to building blocks tends to get "fixed," – ("sweep"), can be a problem

- Deception: a 3-bit deceptive ("trap") function

  (best cure: big enough N)

- Epistasis: nonlinear effects, more difficult to capture if spread out on chromosome



In PRACTICE – GAs Do a JOB

- DOESN'T mean necessarily finding *global optimum*
- DOES mean *sometimes* being able to find *better* approximate answers than other methods do, on some types of problems that occur in engineering and computer science, within the time available, without solution time scaling exponentially with problem size!
- People use any "dirty tricks" that work:
  - Hybridize with local search algorithms/operators
  - Use multiple populations/multiple restarts, etc.
  - Use problem-specific representations and operators
- The GOALS:
  - Minimize # of function evaluations needed
  - Balance exploration/exploitation so get best answer you can during time available (AVOIDING *premature convergence*)