

GA Example by Hand

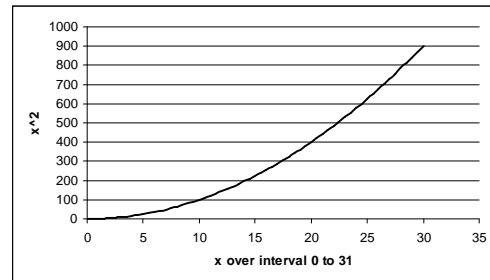
From Genetic Algorithms in Search,
Optimization and Machine Learning.
Goldberg 1989

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Optimization of function $y = x^2$



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Representation

- Assuming Simple GA
 - Binary, fixed length individuals.
 - Number of bits \equiv resolution
 - ... and a function of the size of the input space
 - Use 5 bit format to ensure that 0-31 bits covered
 - Problem mapping therefore just decimal to binary conversion

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Goal

- Objective
 - Find the value for 'x' that maximizes the function $y = f(x)$
- Fitness function
 - The objective as 'seen' by the GA
 - Function used to rank different candidate solutions

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Initial population

Individual	Decoded value	Raw fitness	Proportion	Allocation
1	01101	13	0.14	1
2	11000	24	0.49	2
3	01000	8	0.06	0
4	10011	19	0.31	1

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Create new population

Mating pool	Pairwise ID of mates	Crossover sites	New population
01101	2	4	01100
11000	1	4	11001
11000	4	2	11011
10011	3	2	10000

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Observations #1

- Population
 - Fixed size and consequently results in a competition in which only the fittest survive
- Selection
 - Greedy selection would always match current best with current best
 - Say, string 11000 with 11100.
 - Stochastic Selection provides the potential to select 'less fit' individuals as well as fit.
 - Say, string 11000 with 00111.

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Observations #2

- Search Operators
 - All machine learning problems experience the Exploration / Exploitation trade off.
 - Crossover
 - utilizes material currently in the population
 - Exploitation
 - Mutation
 - (attempts) to introduce material not currently in the population
 - Exploration
 - Note – these are rules of thumb!

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