

GA and Tabu Search
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A Comparative Analysis of Selection Schemes used in GA

Four Commonly used Selection Schemes

1. Proportionate reproduction
2. Ranking selection
3. Tournament selection
4. Genitor (or “steady state) selection

Four Commonly used Selection Schemes

Ranking and tournament maintains strong growth under normal conditions

Proportionate reproduction without scaling is less effective in convergence

Genitor is a simple combination of block death and birth via ranking: linear ranking selection where the worst individual is replaced

Model and Analysis

Overlapping Population Model

$$P_{i,t+1} = P_{i,t} + P_{i,t,b} - P_{i,t,d}$$

Two measures of analysis

1. Takeover time t^* for the best individual: number of generations required for the population to contain $n-1$ best individuals among n starting from one best
2. Time complexity per generation

Model and Analysis

Growth ratio (ratio of the portion of particular strings at time $t+1$ and t) due to selection

Proportionate selection: high early growth ratio and low late growth ratio

Binary tournament selection is equivalent in expectation to the **Linear ranking** in which the best gets two offspring and the worst gets none

Tournament selection can achieve higher growth ratio with larger tournament size; ranking selection with nonlinear ranking functions

Model and Analysis

Takeover time

All selection scheme converge in $\cong O(\log n)$
generations other than the proportionate scheme

Time complexity

Tournament selection is the easiest to make
parallel and the strongest recommendation