GA and Tabu Search
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Royal Roads

Royal Road functions

Building Block Hypothesis suggests two features:

   Presence of short, low-order, highly-fit schemata
   Presence of intermediate stepping stones

One might expect that the GA will outperform simple hill-climbing schemes

Experimental Results

RMHC is nearly a factor of 10 faster than the GA

# of function evaluation to find the optimum on R1: 6179 (RMHC) : 61334 (GA)

Under what conditions will a GA outperform other search algorithms such as RMHC?

Hitchhiking in the GA

What caused the GA to perform so badly on R1 relative to RMHC?

"Hitchhiking"

0's in other positions of the highly fit string hitchhike along with the 1's in the schema's defined position

This slows the discovery of schemas in the other positions

Hitchhiking seriously limits the implicit parallelism of the GA by restricting the schemata sampled at certain loci

Hitchhikers (0's in s_3 loci of s_2 and s_4) prevented independent sampling in the s_3 partition: **biased sampling**

An Idealized GA (IGA)

Lessons from RMHC:

Each string differs from the previous string in only one bit

It is the constant, systematic exploration, bit by bit, never losing what has been found

IGA is defined as

Sequester a first found string that contains one or more of the **desired schemata**

When a string containing one or more not-yet-discovered schema is found, instantly crossover the new string with the sequestered string so that the sequestered string contains all the **desired schemata** that have been discovered so far

IGA is unusable in practice, since it requires knowing precisely what the desired schemata are

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An Idealized GA (IGA)

For GA to approximate features of the IGA

Independent samples: large enough population, slow enough selection process (relative fitness of nonoverlapping desirable schemata has to be small enough to prevent hitchhiking)

Sequestering desired schemata: strong enough selection to preserve desired schemata found, but slow enough selection

Instantaneous crossover

Speedup over RMHC: long enough string to make the factor of N speedup significant