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A NEW QUANTIFYING CROSSOVER WITH TERNARY REPRESENTATION*

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ABSTRACT—As a fundamental operator in genetic algorithms (GAs), crossover may not only make an existing schema survive, but also construct a new one from other existing schemata. Unfortunately, the existing schema theorems do not exactly quantify the positive effects of schema construction by a crossover. Consequently, they cannot well characterize the evolution of a schema. In this paper, a new ternary representation is proposed through which the survival and construction of a schema for any crossover operator can be distinguished easily. Subsequently, the probabilities that a schema will survive and be constructed from other schemata can be estimated for an arbitrary crossover. As a result, we present four new schema theorems, through which the survival and construction abilities of different crossover operations are easier to be compared. Moreover, these results generalize the existing schema theorems.

Key Words: Genetic Algorithm, Schema Theorem, Schema Survival, Schema Construction