

ABSTRACT

The use of Genetic Algorithms in the optimization of the representations of logic functions

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Different formulas/forms can be used to represent one logic function. Depending on the form chosen to represent a function, the implementation of that function may be simpler than another implementation of that same function. As the number of variables increases, we have an increase in the average number of formulas per function. Conventional optimization techniques have proven to be inadequate in handling the optimization of the representations of logic functions of many variables. It is therefore important that we find alternative means of determining the minimal/optimal representation for logic functions.

This research will investigate the use of GAs in the optimization of the representation of logic functions. Genetic operators will change representations of logic functions so as to optimize them. The areas of interest in this research will be the optimization of (i) disjunctive forms, (ii) conjunctive forms, (iii) exclusive-OR forms, and (iv) equivalence forms. These will be optimized in terms of the minimum number of conjunctions as well as the minimum number of variables in each formula. An optimal set of input parameters, for the algorithm, will also be suggested.

The objective of this research was to develop a GA to be used in the optimization of

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the representations of logic functions. This was accomplished and a detailed description of the algorithm is provided. This algorithm uses the basic genetic operations, mutation and crossover, to change the potential solutions until an optimal solution is found. Investigations were carried out to determine a set of input parameters for the program implementing the algorithm. Values for the mutation and crossover operators were determined, through an analysis of the results obtained. However, it was found that the number of generations and the size of the population both depend on the optimization problem and the resources available. No values were therefore suggested for these parameters. The research proved to be very interesting and suggestions for further research is presented.

Keywords: Avril C. Perrotte; Genetic Algorithms; Logic Functions; Optimization.