Shallow Backtracking Points in An Intelligent Backtracking Schema

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Extended Abstract

This paper presents a runtime intelligent backtracking method for prolog programs to avoid redundant failures. The method presented in this paper selects the youngest choice point as a backtracking point during a failure such that backtracking to that choice point can avoid the same failure. The chosen backtracking point depends on the age of the variable causing the failure and the next alternative of the clause in which the failure occurs. It is guaranteed that the chosen backtracking point is the youngest choice point such that backtracking to any younger choice point than the chosen choice point cannot avoid the same failure.

The shallow backtracking point at a certain time of execution is the choice point of the procedure being currently executed or the choice point of its first ancestor having a choice point. The shallow backtracking point also indicates the oldest choice point to which we should backtrack during a failure. In fact, since the shallow backtracking point indicates the next alternative clause of the clause currently being executed and backtracking to that alternative clause will completely skip the clause currently being executed, it is guaranteed that backtracking to the choice point indicated by the shallow backtracking point will avoid a failure occuring in the current clause.

The age of a binding will be the current shallow backtracking point during that binding. Ages of bindings are recorded in a new representation introduced for WAM variables in this paper. Ages of variables can be easily found using this new representation. An age of a variable bound to a ground term is the age of the youngest binding causing that variable to be bound to that ground term. The selected backtracking point for a failure is the youngest one of choice points indicated by the age of the variable causing that failure and the current shallow backtracking point.

The Warren Abstract Machine (WAM) is extended to have the capability of our intelligent backtracking schema. Some of these extensions include a new register holding the current shallow backtracking point, a mechanism maintaining shallow backtracking links among choice points, a new representation for variable bindings and a new failure routine to choose the backtracking point depending on the age of the variable causing that failure and the current shallow backtracking point. These extensions are naturally integrated with the original WAM architecture, and their overheads are kept in minimum.