

Linear-scan Register Allocation

Abstract

Registry allocation algorithm is an important part of a compiler which has high impact on the quality of the generated code. In theory, there is unlimited number of local variables and temporary values in the intermediate code. On the contrary, a processor have only finite number of registers. Therefore, the registry allocation algorithm must be able to decide which local variable and temporary values should reside in physical registers during program execution.

There are several algorithms that were invented to solve registry allocation problem. Graph coloring solution is a traditional approach to deal with this problem. On the other hand, this approach has one severe issue. Because of graph coloring is generally NP-complete, performance is limited.

Linear-scan algorithm tries to overcome the performance problem. It is not based on graph coloring, but instead allocates registers using single linear-time scan of the variables' live ranges. The algorithm is considerably faster and easy to implement. At the same time, generated code is almost as efficient as one using more complex and time-consuming graph based algorithms. The algorithm comes into use in scenarios where compilation time is a concern, such as just-in-time compilers.

Authors:

Andrea Marcelyová, xmarce02@stud.fit.vutbr.cz

Pavel Hrabec, xhrabe00@stud.fit.vutbr.cz

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