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Process optimization

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# Definition

In general, trying to achieve the best design and performance related to a set of prioritized criteria or contraints which is achievable by maxamizing the productivity, strength, reliability, longevity, efficiency, and utilization factors. This process of decision making is known as optimization process.

Code Optimization in Compiler Design. The code optimization in the synthesis phase is a program transformation technique, which tries to improve the intermediate code by making it consume fewer resources (i.e. CPU, Memory) so that faster-running machine code will result. (geeksforgeeks, 2020)

# Objectives

The main objectives of the code optimization can be:

* Increases the compilation’s speed by reduce the space usage.
* An optimized code often promotes re-usability.

# Types of Code Optimization

In general there are two types of optimization proces:

* Machine Independent Optimization

This code optimization phase attempts to improve the intermediate code to get a better target code as the output. The part of the intermediate code which is transformed here does not involve any CPU registers or absolute memory locations.

* Machine Dependent Optimization

Is normally done after the target code has been generated and when the code is transformed according to the target machine architecture. It involves CPU registers and may have absolute memory references rather than relative references. Machine-dependent optimizers put efforts to take maximum advantage of the memory hierarchy.

# Code Optimization Methods

Code Optimization is done in the following different ways :

* Compile Time Evaluation
* Variable Propagation
* Dead code elimination : Variable propagation often leads to making assignment statement into dead code
* Code Motion :  
  • Reduce the evaluation frequency of expression.  
  • Bring loop invariant statements out of the loop.
* Induction Variable and Strength Reduction :  
  • An induction variable is used in loop for the following kind of assignment i = i + constant.  
  • Strength reduction means replacing the high strength operator by the low strength.

# Where to apply

The best place for applying the optimization could be:

* Sourceprogram  
  Optimizing the source program involves making changes to the algorithm or changing the loop structures where the user is the actor.
* Intermediate Code  
  Optimizing the intermediate code involves changing the address calculations and transforming the procedure calls involved. Here compiler is the actor.
* Target Code  
  Optimizing the target code is done by the compiler. Usage of registers, select and move instructions is part of optimization involved in the target code.

Phases of Optimization  
There are generally two phases of optimization:

* Global Optimization:  
  Transformations are applied to large program segments that includes functions, procedures and loops.
* Local Optimization:  
  Transformations are applied to small blocks of statements. The local optimization is done prior to global optimization.