

Assignment P3 – Not a Drill

Formal assignment description - INFOMOV
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Introduction

This document describes the requirements for the final assignment for the INFOMOV course. For this assignment you will optimize an application of your own choice, by applying the structured optimization process, using the means discussed in the course.

Application

For this assignment you may use any application as a starting point. The application may be your own work, or an open source project, or one of the proposed crowd simulation projects. It may be written in C++ or any other language. It may be near-optimal or not optimal at all. Do however pick a project that allows you to showcase your skills.

For the 2019 course, several projects have been proposed by Roland Geraerts. Additional projects related to the Lighthouse 2 project are also available. See the website for details.

Structured Process

In one of the first lectures a structured approach to program optimization was proposed. The approach revolves around profiling to guide effort. The steps are:

0. Determine the optimization goals.
1. Profile to determine bottlenecks.
2. Apply high-level optimizations (typically: those that reduce algorithmic complexity) to the bottlenecks.
3. Profile again.
4. Apply vectorization, GPGPU, and/or multi-threading, if applicable.
5. Profile.
6. Apply low-level optimizations.
7. Repeat steps 5 and 6 until time runs out.
8. Report.

Depending on the project you may or may not actually apply steps. Profiling should however always play a central role, and effort should always be aimed at the determined bottlenecks.

Means

During the course we discussed low-level optimizations, SIMD, GPGPU, caching, data-oriented design, fixed point arithmetic, compiler output and many other smaller topics. For the final project all of these can be used, but it is up to you to determine which techniques are actually useful.

Team

You may work on this assignment alone, or with one partner. You may team with one partner for all assignments, but it is also allowed to change teams per assignment. You cannot change your team halfway an assignment; if for whatever reason you don't want to finish the project with your partner, both of you will work alone. Both team members may continue working with the code that was produced up till the split.

You may exchange information about the project with other students, online or in real life. Do not share code snippets, limit the exchange to ideas, hints, concepts and taunts.

Grading

Your final grade will be determined primarily by your report, which should describe how you approached the optimization. Grades will be assigned roughly as follows:

- 4 and lower: your application does not work, did not improve or has broken functionality after the optimization.
- 5: you did make the application faster, but it is not clear why, or the report does not contain proof that the optimization was conducted in a structured manner.
- 6: you did make the application faster, but you ignored bottlenecks indicated by the profiler, because you got distracted or perhaps because you didn't master the applicable technology, such as SIMD or GPGPU.
- 7: this is the baseline: reasonable speedup, approach and report.
- 8: above average: ~90% of the potential was realized, thanks to diligent profiling and a clearly documented approach.
- 9: exceptional: close to 100% of the potential was realized, profiling now ping-pongs between a few already optimized bottlenecks. Or: 8, plus acceptance by the open source community of your improvements ("peer-reviewed optimizations").

The final point is reserved for special cases.

Deliverables

Your submission will consist of the optimized code plus project files. If any tools beyond Visual Studio 2017 / 2019 are required to produce the intended executable, please add a readme that contains instructions.

Apart from the project you are expected to produce a report. This is in most cases your primary deliverable.

Deadline

The deadline for this assignment is **Thursday October 31st, 23:59**. You may submit your work up to 24 hours later; the penalty for this is 1 point.

Academic Conduct

The work you hand in must be your own original work, or properly referenced. If you used materials from other sources, please specify this clearly in the `readme.txt`.

The End

Questions and comments:

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INFOMOV 2019