ECE 555 Group Presentation

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April 2, 2025

Why not Just Use C?

It should not be used for production.
See `https://veresov.pro/cmustdie/`

Why Rust?
Type System

insert real/fake cat example from
`https://www.youtube.com/watch?v=z-0-bbc80JM&t=514s`

Why Rust?
Safety

Insert image of my IDE showing an error such as attempting to use a value after it is moved out of scope.

Why Rust?
Ergonomics while remaining fast

Here I may include my rust implementation of project 1 and compare it to my C version in both ergonomics, safety, and speed.

Why Rust?
Single threaded bsort

Listing 1: Single threaded bsort

```
1  a.chunks_mut(split_length)
2      .for_each(bsort);
```

- a is a vector of numbers
- `chunks_mut` slices the vector into non-overlapping slices of the given length
- `for_each` iterates over the chunks, running the provided function with each chunk as the input.

Why Rust?
Concurrency is easy while avoiding race conditions

```
1    a.chunks_mut(split_length)
2        .par_bridge()
3        .for_each(bsort);caption
```

- Chunks is known to split a vector into distinct slices
- Hence we can safely send each chunk to a different thread

Rust and CUDA
Current options

- Rust GPU
- Rust CUDA

Maybe mention other options for GPU programming in rust, like any rust support for ROCm, HIP, intel gaudi, or other.

Rust and CUDA

Description of how the Rust-CUDA crate works

Rust and CUDA

Problems with shared memory access in rust, therefore we need to use unsafe

Currently being rebooted and is in active development.
Uses nvidia's nvvm tool which is built on LLVM 7.

What is a compiler?

Description of problems when going straing from source code to machine code.

The problem LLVM solves

Description of LLVM and it's intermediate representation and how this has enabled much easier language development.

NVVM

How NVVM works

Rust CUDA and NVVM

How NVVM is used in Rust CUDA

$c \in \mathbb{C}$ is in the mandelbrot set if the sequence $\{z_n\}$ converges.

$$z_{n+1} := z_n^2 + c \qquad z_0 = 0$$

The Burning Ship fractal is defined similarly but the sequence is

$$z_{n+1} := (|\mathrm{Re}(z_n)| + |\mathrm{Im}(z_n)|i)^2 + c \qquad z_0 = 0$$

Fractals
Timing Results for 1 frame on CPU and GPU

I will add the single, frame timing results here

I plan to be sharing my screen for the presentation and will switch to a live demo here.

This is a slide
With a subtitle

This is some text in a column. Could be a figure instead.

- This is a list
- It is an itemized one
- Hence the bullets