



Senior Project – Computer Science – 2014

Designing a simulation of a superscalar processor

William Callanan

Advisor – Prof. Fernandes, Prof. Rieffel

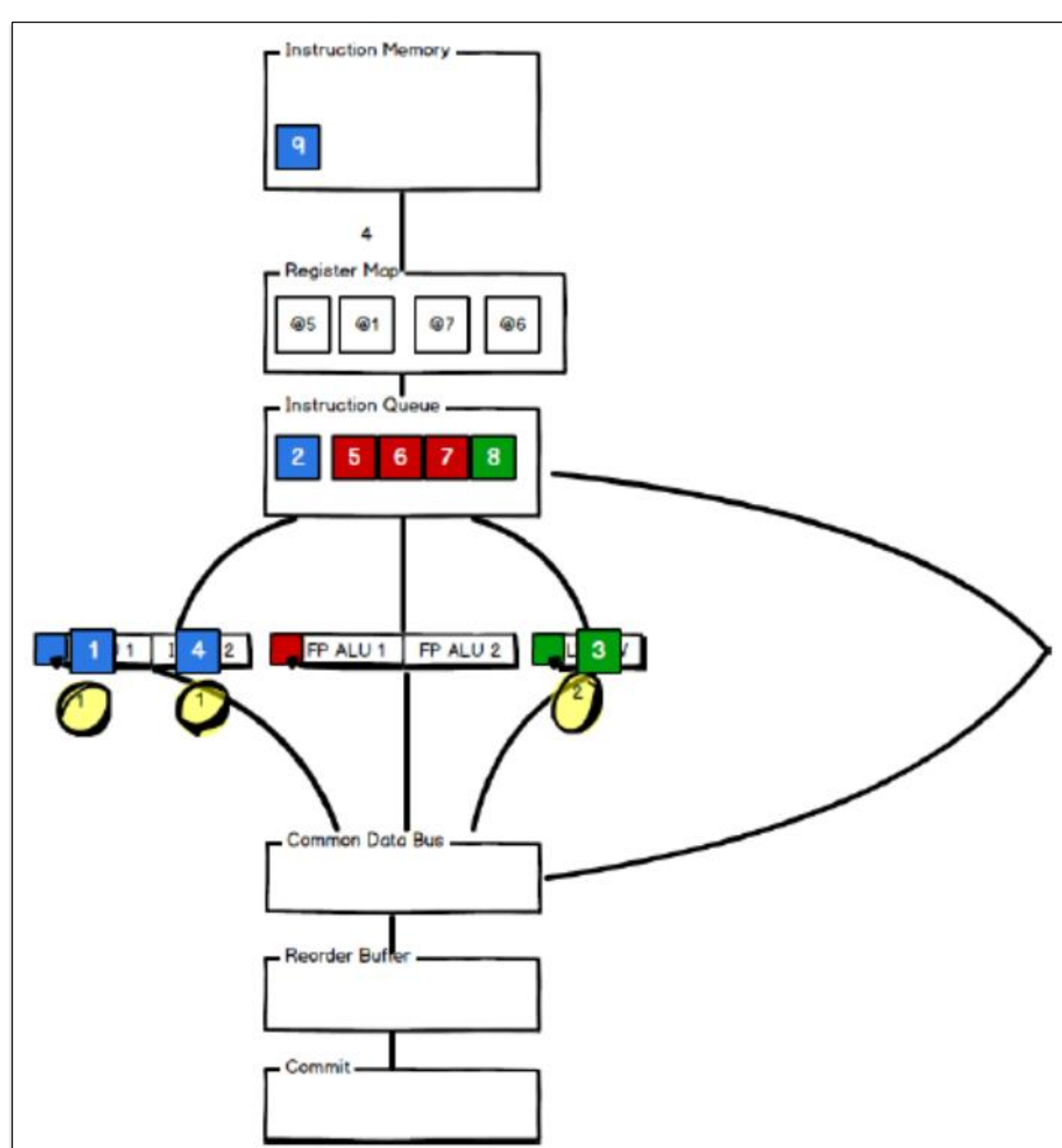
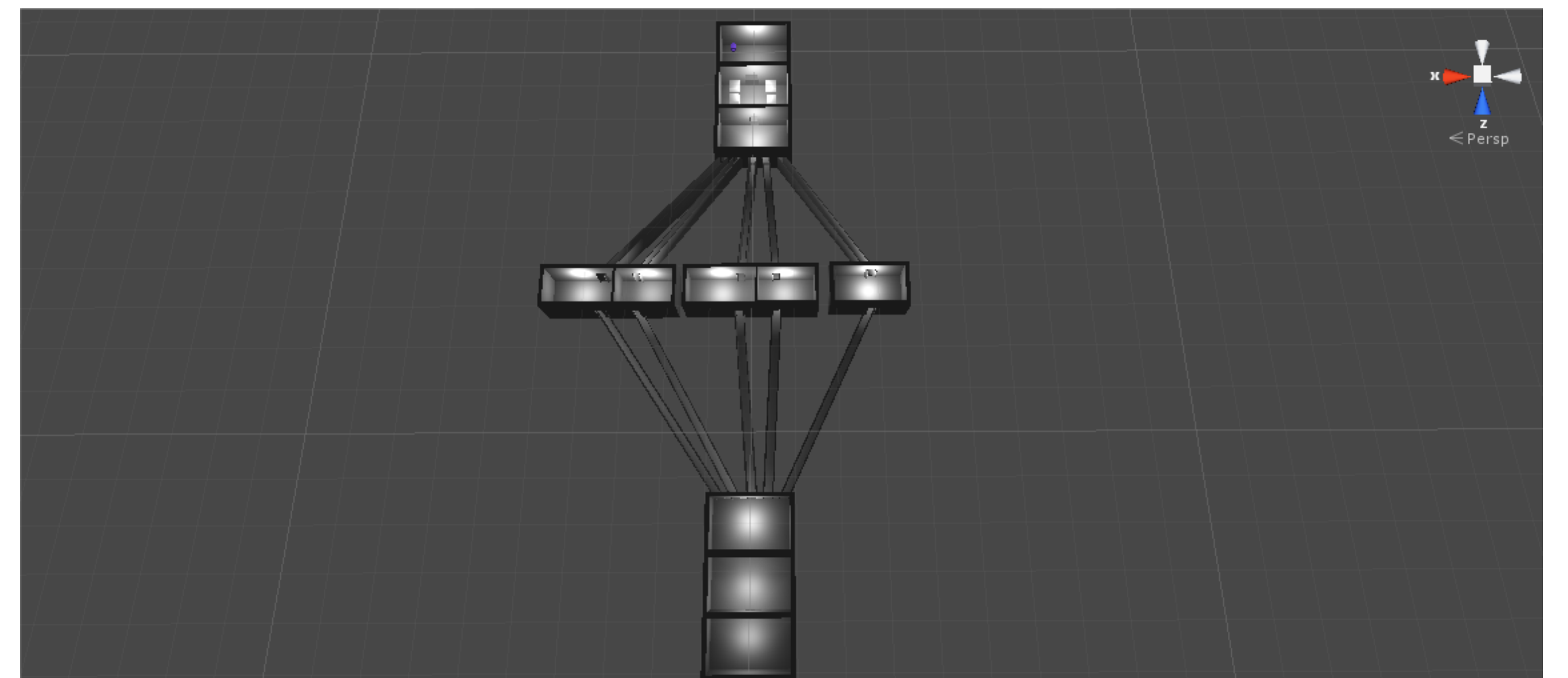


Introduction

Processors are an important aspect of a Computer Science education. Traditionally they are taught in a simplified form known as scalar, where the processor only deals with one piece of information at a time, because it is simpler. But there are more complex processors that deal with multiple pieces of data at once, these are known as superscalar processors.

Objective

To design and build a simulation of a superscalar processor that would be easy for a computer organization student to understand.

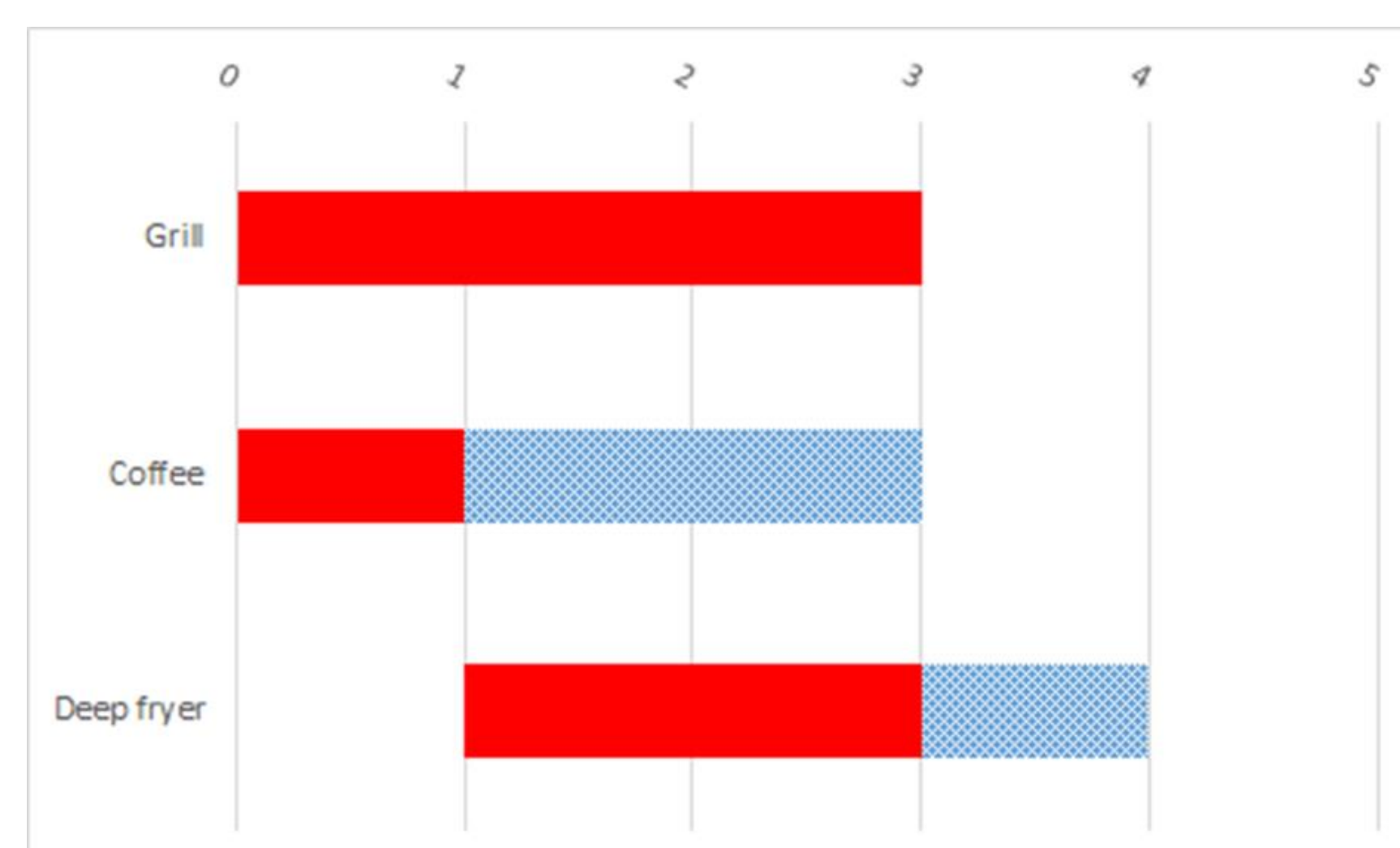


What is a Superscalar processor?

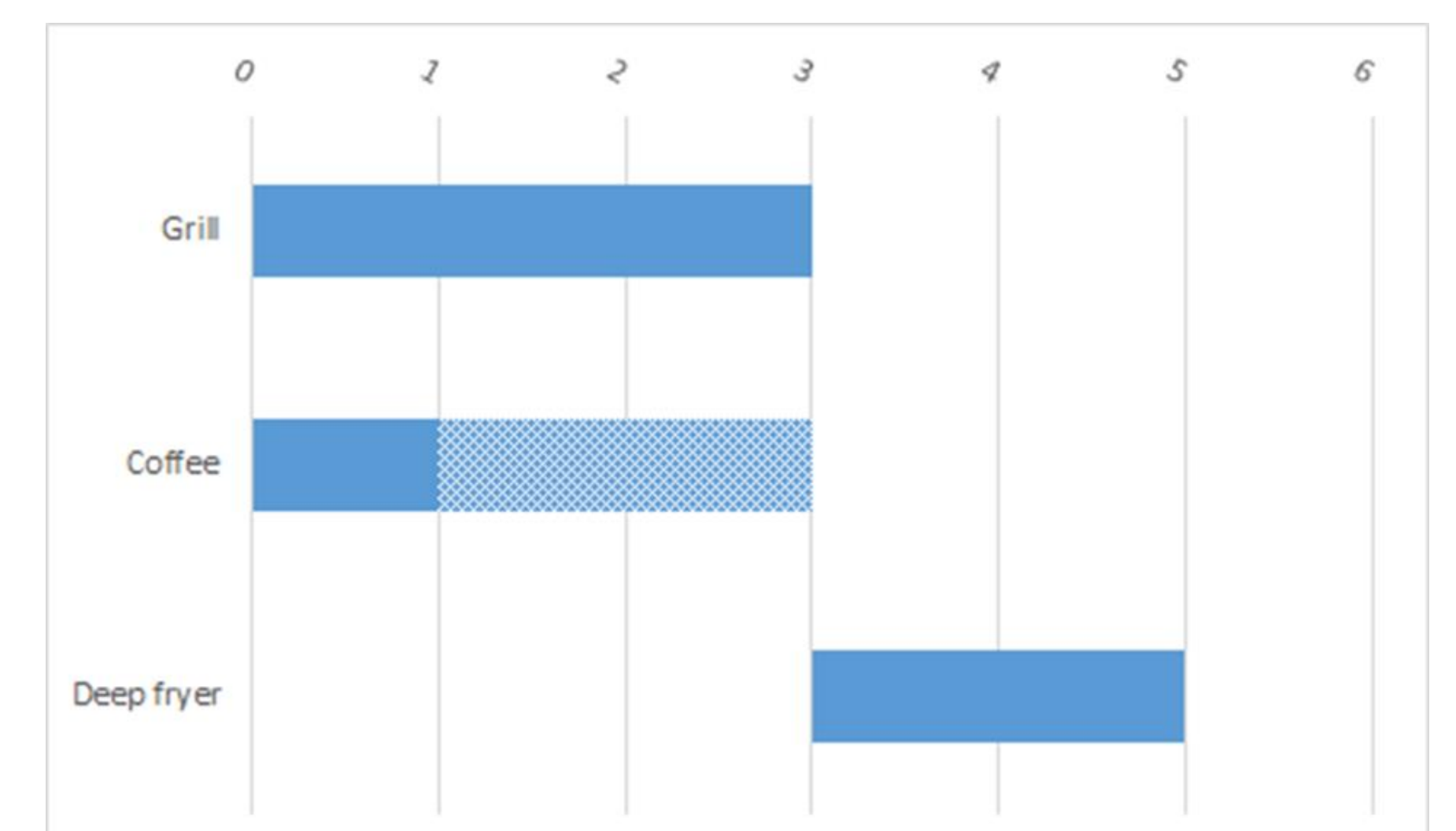
A superscalar processor can be thought of like a fast food drive through, people order their food, and then receive their food when it is their turn. But inside the restaurant meals can be made in any order, so one person's meal might be ready before they reach the delivery window to pick it up. Superscalar processors function in a very similar way, instructions enter the processor executed in the quickest order, then the results are committed in order, so that the illusion that things are being done in order is maintained.

A comparison between scalar and superscalar

Superscalar

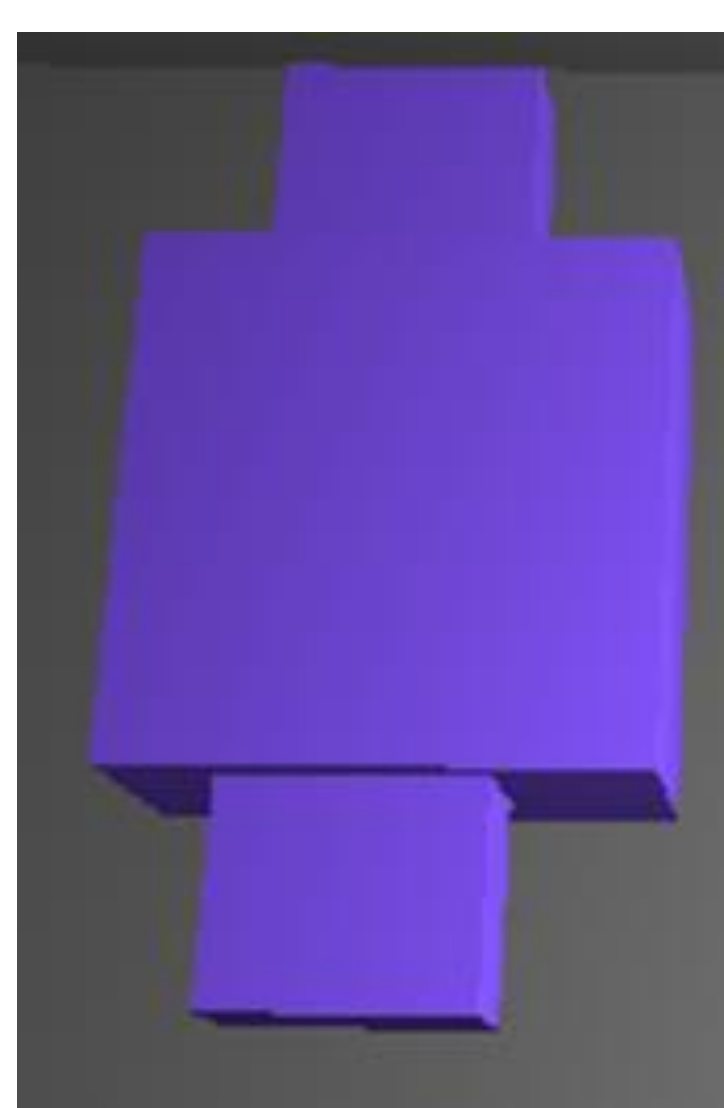


Scalar

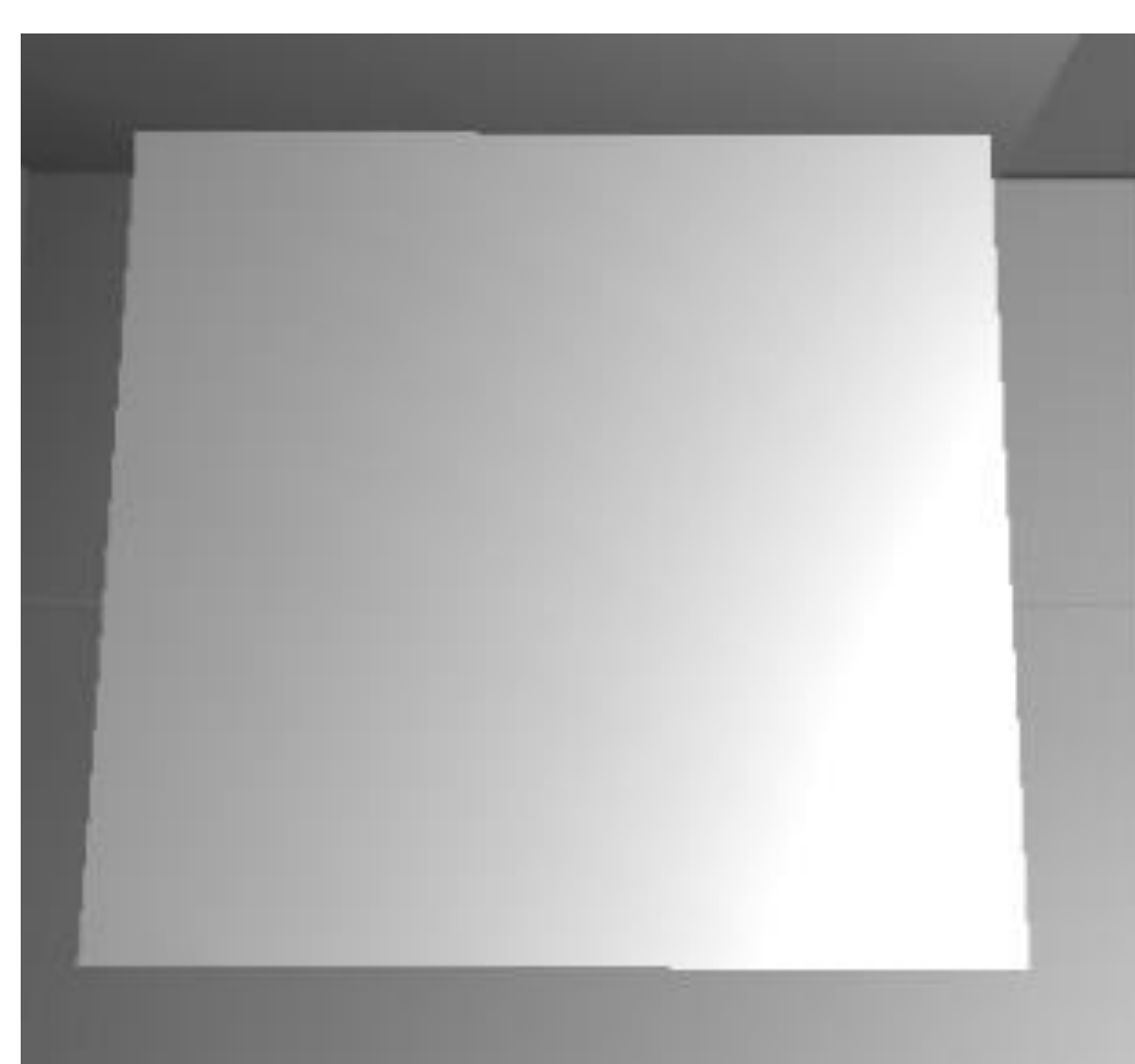


Current features of simulation

- Registers
- Winged instruction model
- Color coded instructions
- Moveable camera
- Automated instruction movement



Instruction



Register

Future Work

There are many useful features that could be added to this simulation, one of the biggest ones would be full running examples. After those are finished Support for student programs would be very useful so students could see the speed improvements that things they have built see from being run in superscalar. Manual mode, or a mode where the simulation is run by the student instead of the computer would be useful as a sort of game component, letting the student find the most efficient way to run the program. A mode that simulates a scalar processor allowing the students to compare how the two function would also be an important future feature. These are the big features that I would like to add, however there are some smaller things like adjustable speed and zooming that I think would be useful for future versions as well.