

Homework 1

Due: January 31, 2022

1. (10 points) List **two** real-world examples of ASICs that are programmable with instructions. For each example, list the following information: (a) name, (b) basic functionalities, (c) application scenarios, (d) programming language, and (e) examples of basic instructions/operators.
2. (10 points) List the major components in an FPGA and briefly explain what they are used for.
3. (10 points) Briefly explain the differences between CPU and GPU in terms of their architectures and use scenarios.
4. (40 points) A commercial microwave oven has an embedded system controlling its operation. It has a start button, a cancel/stop button, a button for increasing cooking time by 30 seconds, and a sensor that monitors if the oven door is open or closed. The door needs to be closed for the microwave oven to work.
 - (a) (10 points) Write down the pseudo code that models the behaviors of this system.
 - (b) (15 points) Draw the FSMD diagram for this system.
 - (c) (15 points) Separate the FSMD into FSM and datapath. Make sure the inputs and outputs of FSM and datapath are clearly marked.

NOTE: The system definition is very general. Different assumptions can be made. There could be multiple correct solutions.

5. (30 points) Write a piece of code in your favorite programming language to exchange the values of two variables, a and b. Then, Draw/print the Abstract Syntax Tree (AST) of this code. Assume that a and b have been declared and initialized. You can use tools (e.g., compiler front-ends or some AST libraries) to print the AST or you can draw AST manually. You can show your AST in tree structure or in text form. Make sure that the AST matches the grammar of the language you choose.