Laboratory 1

(Due date: Sep. 24th)

Objectives

- Learn about the DE2i-150 board and its components.
- Learn about the operating system: Ubuntu.
- Write, compile and execute simple C applications.

Terasic DE2i-150 Development Kit

* You can alternatively complete these activities using a Linux laptop.

Documentation

- Refer to the board website or the Tutorial: Embedded Intel for User Manuals and Guides. We mention the information that is relevant for the Microprocessor system (these documents heavily focus on the FPGA system):
  - ✓ DE2i-150 Quick Start Guide: To quickly connect the power, mouse, keyboard, display for the Intel® Atom™.
  - ✓ DE2i-150 Getting Started Guide: Details on powering the Board.
  - ✓ DE2i-150 FPGA System User Manual: Installation of WiFi Module and Antenna on DE2i-150.
  - ✓ DE2i-150 Windows 7 User Manual: Boot DE2i-150 with a Bootable USB Flash Drive
  - ✓ Installing Ubuntu OS on the DE2i-150: Some tips for Ubuntu OS installation. * We use a USB flash drive with an image.

Tutorial

- Refer to the Tutorial: High-Performance Embedded Programming with the Intel® Atom™ platform for a list of tutorials and a comprehensive list of examples.

Activities

First Activity: Board Setup and Basic Utilities

- Refer to the *High-Performance Embedded Programming with the Intel® Atom™ platform → Tutorial 1* for a detailed list of steps.

- Open the DE2i-150 Development Kit. Connect the monitor (VGA or HDMI), the keyboard, and the mouse.
- Power up the DE2i-150 Board.
- Navigate to the `/home` folder (graphically or via the Terminal).
- Create a work folder in the `/home` directory.
- Open a new blank file using Kate (or your favorite Text Editor).

Second Activity: Numerical Sequence (50/100)

- This is a numerical sequence for $n > 1$:

$$F_n = F_{n-2} + F_{n-3}$$

$$F_0 = 1, \qquad F_1 = F_2 = 0$$

- Write a `.c` program that reads in the parameter n, computes and displays the elements of the sequence (F_0 to F_{n-1}).
  - ✓ Your code should measure the computation (only the actual computation portion) in us.

- Compile the code and execute the application on the DE2i-150 Board. Complete Table I.
  - ✓ Example: `./mysequence 20`

- Take a screenshot of the software running in the Terminal (for $n = 50$).

Table I. Computation Time (us) vs. Parameter n

n	Computation Time (us)
100	
200	
300	

THIRD ACTIVITY: COMPUTATION OF π (50/100)

- To compute π, we can use the following formula:

$$\frac{\pi}{4} = \sum_{k=0}^{\infty} \frac{(-1)^k}{2k+1}$$

- The equation is a sum of a function $f(k) = \frac{(-1)^k}{2k+1}$ applied to every index k (from 0 to $n-1$). Using $n = 100{,}000$ iterations can produce a precise enough value of π.

- Write a `.c` program (use `double` variable for computations) that reads in the parameter n, computes and displays π.
  - ✓ Your code should measure the computation (only the actual computation portion) in us.

- Compile the code and execute the application on the DE2i-150 Board. Complete Table II.
  - ✓ Example: `./mypi 100000`

- Take a screenshot of the software running in the Terminal (for $n = 100{,}000$).

TABLE II. COMPUTATION TIME (US) VS. PARAMETER n

n	π	Computation Time (us)
50,000		
100,000		
200,000		
500,000		

SUBMISSION

- Demonstration: In this Lab 1, the requested screenshots of the software routines running in the Terminal suffices.
  - ✓ If you prefer, you can request a virtual session (Zoom) with the instructor and demo it virtually.

- Submit to Moodle (an assignment will be created):
  - ✓ Two .zip files (one for the 2nd Activity and one for the 3rd Activity).
    - Each .zip file must contain the source files (.c, .h) and the requested screenshot.
  - ✓ The lab sheet (a PDF file) with the completed tables.

TA signature: _____ **Date:** _____