

Laboratory 1

(Due date: Sep. 26th)

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

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.

ACTIVITY

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 $n > 1$:

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

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

- 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)
20	
50	
70	

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: _____