Digital Design Verification

FYP/Internship Program

Lab # 03

Arrays & Functions

Release Date: 30-July-2024

NUST Chip Design Centre (NCDC), Islamabad, Pakistan

Revision History

Revision Number	Revision Date	Revision By	Nature of Revision	Approved By
1.0	30/07/2024	Dr. Abid	Complete manual	-
1.1	14/02/2025	Hira Sohail	Revision in manual	

Contents

Objective

The objective of this lab is to enable students to answer following questions:

- How arrays help us in organizing data?
- How to perform operations on arrays?
- How to represent 2D arrays?
- How to handle multiple files?

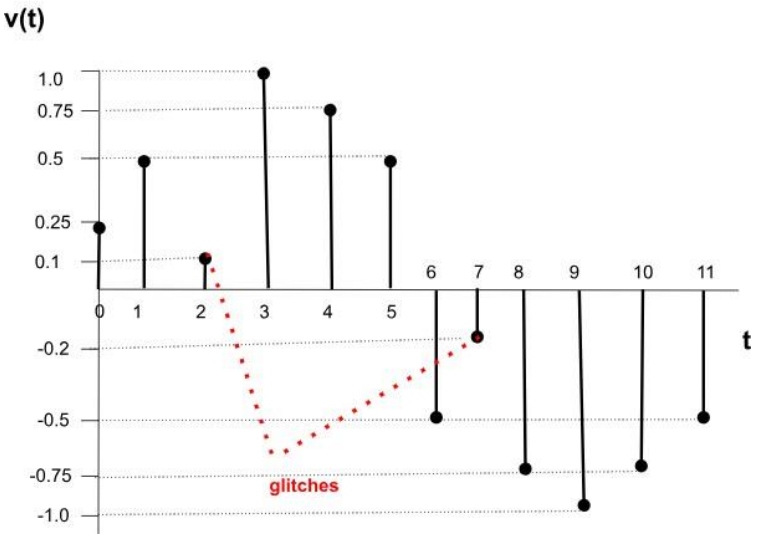
Tools

- GNU debugger
- GC compiler

Lab Task # 01

Signal Processing

Consider a 1D AC sinusoidal voltage signal that is digitized and is stored in the computer.



i. What data type will be used to store **v(t)** for these values of **t**? Initialize **v(t)** as well.

ii. Write a program (flow chart) to compute the DC (average) value of the sinusoidal signal.

iii. Modify the program to detect when the signal crosses the x-axis.

iv. Modify the program to detect the glitches in the signal.

Lab Task # 02

String Library

Take an input sentence (maximum length N = 100) and perform the following operations on the sentence using functions. Prepare string.h and string.cpp as library files and use that library in main.

a. Length of the sentence
b. Sentence in lowercase
c. Sentence in uppercase
d. Number of words in the sentence
e. Number of vowels
f. Frequency of the vowels

Lab Task # 03

Write an image processing library to carry out the following functions. Your image will be a 3D array containing RGB values.

- Find the type of pixels in the image. Your function should take pixel type as input (0 — black, 1 - white, 2 - yellow)
- Perform RGB to GrayScale conversion
- Perform convolution on the 2D grayscale image with following filter

H = [1 1 1 ; 1 1 1; 1 1 1]/9;

Submission:

Please submit .c and .h files of all the tasks along with the screenshots of outputs on LMS in a proper report. Add snaps of all the flow charts in your report.