LabVIEW 3: Data Files, Shift Registers, Case & Sequence structure

Reading :

Hands-On Introduction to LabVIEW by J. Essick

Reading	pages	optional
Chapter 5	All	
Chapter 6	page 1-3	All
Chapter 7	page 1-3	All
Chapter 8	All	

Optional: Handout, page 1-8

Main focus :

- Learn how to write and read data
- Learn to use Shift Registers and the Case Structure.
- Know how to force LabVIEW to perform tasks in a desired sequence and learn different ways of doing this.
- Fourier Series

Most relevant VI's : None

Due Date: Wednesday, 11AM, Nov. 26

Assignments: Hand in a printout of the *Block Diagram* and *Front Panel*, where the *Front Panel* graphs should display relevant data. Make sure to include your name and date and most importantly sufficiently detailed comments. The comments on the *Block Diagram* should concern the details of how the program works, and why you chose to use certain LabVIEW language programming structures. The comments on the *Front Panel* can be used to talk about the meaning of the results.

Problem 1: Attach the analytic solution to Problem 1 as a separate sheet. Do calculations yourself, that is do *not* use Mathematica's "FourierSeries" command or other symbolic software to solve the problem. You are of course free to use it to check your answer. Although you need to show the steps leading to the solution, simple integrals such as

$$\int x \sin(x)\, dx = \sin(x) - x\cos(x) + C \tag{1}$$

can be used without further derivation. Only neatly written up solutions will be accepted. Solutions typeset with LaTeX are preferred.

1. Consider a triangle wave of period T and amplitude A (peak to peak amplitude: $2A$).

$$f(t) = \begin{cases} -2A - \frac{4A}{T}t & -\frac{T}{2} \le t < -\frac{T}{4} \\ \frac{4A}{T}t & -\frac{T}{4} \le t < \frac{T}{4} \\ 2A - \frac{4A}{T}t & \frac{T}{4} \le t < \frac{T}{2} \end{cases} \tag{2}$$

Develop the Fourier Series of the triangle wave.

2. (a) Chapter 6, page 34, Problem 2. – **Sum of Sines** to form a square wave and explore the Gibbs phenomenon.

(b) Do the same for a triangle wave. Use your result from Problem 1 to create a triangle wave from a sum of sines. Is there a Gibbs phenomenon? Explain.

3. Chapter 8, page 19, Problem 1. – **Blinking LEDs (Sequence Structure)**: In short, using a Sequence Structure, develop a program that turns on (and off) 5 LEDs one-at-a-time in order. Based on your work in Assignment 2 - make 5 physical LED's blink.

More precisely, the program should turn on and off the physical and front-panel LEDs simultaneously. **Indicator Cluster:** Put on the front-panel 5 output LEDs into an indicator cluster (save this indicator cluster if you have not done so previously). You may use the LED cluster from Assignment 2. **LED subVI**: Organize your program by splitting off the LED part as a subVI from the decision part. That is, create a **LED.vi** that takes 5 boolean inputs for the 5 LEDs and one boolean stop input. If the stop input is false, the 5 LED inputs determine the state of both the physical and front-panel LEDs, *i.e.* the subVI turns on and off the physical LEDs and has as an output the 5 LED indicator cluster that you saved previously. If the stop input is true, all LEDs are turned off. The VI output should be the LED-cluster that you previously created, which can then be simply connected to a similar LED cluster in the main program. Creating this SubVI also implies that you have to edit the LED.vi icon.

4. Chapter 8, page 19, Problem 2. – **Blinking LEDs (State Machine)**: In short, using a nested While Loop and a Case structure, develop a program that turns on (and off) 5 LEDs one-at-a-time in order. Based on your work in Assignment 2 and the problem above - make 5 physical LED's blink.