Introduction to LabVIEW – part of the course ”Datoranvändning i fysiken”, FK4012

Exercises
For grade E, exercise 1 through 5 should be completed. For grade C, exercise 1 through 8 should be completed. For grade A, at least 11 of 13 exercises should be completed.

Grade E

1a. Write a program that outputs a given string (your name) backwards.
Uses: string functions, array functions

1b. Write a program that calculates the n:th Fibonacci number F_n for $n > 1$, given the recurrence relation $F_n = F_{n-1} + F_{n-2}$, $F_0 = 0$, $F_1 = 1$. Check: $F_{20} = 6765$.
Uses: for loops, shift registers

1c. Write a program that calculates the average and standard deviation of the integers 0, 1, 2, …, 100. Do the same thing both using available routines and ”the hard way”.
Uses: arrays, probability & statistics

2. Create a project and add the VIs of problem 1 to it. Rewrite the VIs to take suitable input parameters and return results as sub-VIs called by a main VI. Design icons for the sub-VIs. Write a main program that calls the sub-VIs on demand.

3. Write a program that programmatically moves a small picture on the screen in a circle. Configure the VI settings to only show the picture. Build a stand-alone application.
Uses: Property nodes, application builder

4. Write a program that measures the duration that a key (space) is pressed down. Write the program so that no other keys will interfere with the result.
Uses: Event structures, local variables, shift registers

5. Perform a Monte Carlo simulation to determine the value of π. Use Wikipedia for background material.

Grade C, D

6. Make a .vi that loads a text file and lists its 10 most common words.

7. Generate a square wave waveform of 500 Hz frequency, containing 10 k samples and having a duration of 1 s. Add some gaussian noise. Perform a Fast Fourier Transform (FFT), plot it and determine the amplitude of the 3 lowest harmonics.
Uses: Waveforms, library functions, clusters, graphs

8. Create simulated data y(x) = sin(x)/x for x from –6π to 6π. Add 5% random, gaussian noise. Perform a cubic spline fit to the data. Adjust the balance parameter so that the fit closely matches the original data. Plot the original data, the data with noise and the fit together in one graph.
   Uses: Clusters, library functions

Grade A, B

9. Make a program that loads a .jpg picture, scales it to max 640x480 pixels and plots it on the screen.

10. Write a program that generates and plots a selected part of the Mandelbrot set.
    From Wikipedia: The Mandelbrot set is a set of points in the complex plane, the boundary of which forms a fractal. Mathematically, the Mandelbrot set can be defined as the set of complex c-values for which the orbit of 0 under iteration of the complex quadratic polynomial $x_{n+1} = x_n^2 + c$ remains bounded. Eg. c = 1 gives the sequence 0, 1, 2, 5, 26… which leads to infinity. As this sequence is unbounded, 1 is not an element of the Mandelbrot set. On the other hand, c = i gives the sequence 0, i, (-1 + i), –i, (-1 + i), -i… which is bounded, and so it belongs to the Mandelbrot set.

11. Simulate a random walk in two dimensions with a square grid. Plot distance from ”home” as a function of total walking distance.

12. Write a program (sonograph) that samples the sound input and creates a spectogram of the sound. If there is no microphone, test the program by downloading or generating a sound file and use that data for the analysis.

13. A seconds pendulum has a period of two seconds. Graphically simulate the motion of such a pedulum. Let the user be able to adjust gravity and the length of the pendulum within certain limits. What is the length of the pendulum at standard gravity? For the really skilled programmer: simulate a double pendulum.