Assignment 1

Welcome to PyRTL[1]

PyRTL Installation:

Installation of PyRTL is very easy. The following is from the manual written by one of the authors and pioneers of this fantastic project, Dr. Tim Sherwood, UC Santa Barbara.

To install this package you can issue this command in terminal in all three major operating systems Windows, Mac and Linux:

```
pip install pyrtl
```

PyRTL is listed in PyPI and can be installed with **pip** or **pip3**. If the above command fails due to insufficient permissions, you may need to do **sudo pip install pyrtl** (to install as superuser) or **pip install --user pyrtl** (to install as a normal user). PyRTL is tested to work with Python 3.8+.

Using the Template (skeleton file)

You will develop your project on the skeleton file which has the necessary parts for your project to work and you build up on that. The files exist in the repository named **lfsr_combinatorial.py** and **lfsr_behavioral.py**.

A Few Words About LSFR

LFSR or Linear Feedback Shift Register is a digital circuit that is used for generation of pseude-random numbers. The generated numbers are not completely random but psuedo-random as this circuit repeats the generated numbers after a very long time. These two links give good information on LFSR:

From Wikipedia.org

https://en.wikipedia.org/wiki/Linear-feedback_shift_register

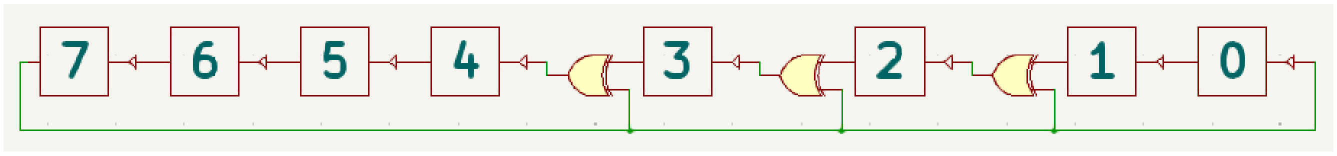
From eetimes.com

https://www.eetimes.com/tutorial-linear-feedback-shift-registers-lfsrs-part-1/

1 This assignment is inspired by CSE x25 - Assignment 1 used in UC Santa Cruz

Assignment 1

Below is a diagram of an LFSR. Note that the boxes with numbers inside them are not flip-flops, they are modules that you have to implement the way that the whole LFSR can be initialized to a predetermined number upon Initialization and keeps on generating pseudo-random numbers in the output of each box. The arrows indicate the data flow. The numbers inside the boxes are the bit position for this 8 bit LFSR.



PART 1

LSFR implementation in Combinatorial Logic

In this part, you will implement the LFSR in a combinatorial way. Although it's not a practical way to do in PyRTL, because PyRTL is made to use abstraction. You will come out of this part of the lab appreciating the abstraction and see how abstraction makes designing digital circuits much easier.

Create the necessary modules separately and then wire them up together. Your circuit should have means by which the LSFR can be initialized to a predetermined number so that it starts generating pseudo-random numbers starting with that number. The bits of the generated 8-bit numbers are tapped from the output of the boxes. Use the skeleton file **combinatorial.py** and build up your LFSR using that.

PART 2

LFSR implementation in Behavioral Logic

In this part, you will develop the LSFR in behavioral way. Use the skeleton file **behavioral.py** and build up your LSFR using that.

Once you are done with the implementation of both combinatorial and behavioral LFSRs, submit your files along with the lab write up and please include a snapshot of PyRTL terminal waveform viewer which is initialized by the number "A5", in which case the second generated number should be "57" the rest of it is up to you to find what is the sequence of generated numbers in your wave form starting from "A5".