

National Tsing Hua University
Department of Electrical Engineering
EE429200 IC Design Laboratory, Fall 2022

Homework Assignment #3 (5%)

Logic Synthesis for Enigma

Assigned on Oct 20, 2022

Due by **Nov 03, 2022**

Assignment Description

Perform logic synthesis for the Enigma you designed in Homework #2. An RTL redesign to improve the performance is allowed and encouraged. Be sure that your RTL code can **pass all the test pattern** in Homework #2. The grading will be based on the following performance index:

A: Total area (shown in report/report_area_enigma.out, e.g. **Total area: 30000**)

T: Timing (your timing constraint, e.g. **5.0** for a nice implementation)

$$\text{Performance index}(PI) = A \times T \text{ (e.g. } 1.5 \times 10^5 \text{ for the above example)}$$

For this problem, you need to complete the following missions:

1. Show the logic correctness and synthesizability functional module by delivering a functional module **enigma_part3.v (or enigma_part2.v)** and its spyglass report **spyglass.rpt**. You will get 0% if failing to achieve this requirement.
2. Perform logic synthesis with the provided scripts. Only two script files can be modified: **0_readfile.tcl** for adding your self-defined RTL files, and **synthesis.tcl** for changing the clock timing constraint TEST_CYCLE (e.g. 10 for 10 ns). Your timing slack should not be negative.

Grading policy

1. There are two grading policies provided. You can choose either one for your final score of this homework.

- **Policy1 (for enigma_part3.v)**

- a. RTL coding and pass pre-simulation (**encryption and decryption**)
- b. Use spyglass to show the synthesizability

$$\left\{ \begin{array}{l} \text{Rank A (5\%): } \text{if } PI \leq 7.5 \times 10^4 \\ \text{Rank B (3\%): } \text{if } 1.0 \times 10^5 \geq PI > 7.5 \times 10^4 \\ \text{Rank C (2\%): } \text{if } PI > 1.0 \times 10^5 \end{array} \right.$$

- **Policy2 (for enigma_part2.v)**

- a. RTL coding and pass pre-simulation (**encryption and decryption**)
- b. Use spyglass to show the synthesizability

$$\left\{ \begin{array}{l} \text{Rank } B_1 \text{ (2\%): } \text{if } PI \leq 6.00 \times 10^4 \\ \text{Rank } C_1 \text{ (1\%): } \text{if } PI > 6.00 \times 10^4 \end{array} \right.$$

2. **Bonus.** For **Rank A** works, **2%** will be given to **the best work** in terms of the performance index, and **1%** given to the second best.

Notice: Late assignments will not be counted in the ranking!

3. A text file **misc.txt** summarizing your Rank, performance index and your A, and T as well.

Deliverable

Note: 1% punishment for wrong file delivery

File Organization

Directory	Filename	Description
HW3_10XXXXXXXX/hdl/	enigma_part3.v or enigma_part2.v	Enigma Machine hdl code
HW3_10XXXXXXXX/hdl/	spyglass.rpt	Spyglass report
HW3_10XXXXXXXX/syn/	0_readfile.tcl	Synthesis script
HW3_10XXXXXXXX/syn/	synthesis.tcl	Synthesis script
HW3_10XXXXXXXX/syn/	report_area_enigma.out	Area report
HW3_10XXXXXXXX/syn/	report_time_enigma.out	Timing report
HW3_10XXXXXXXX/	misc.txt	Your rank and performance