國 立 中 興 大 學

資 訊 科 學 與 工 程 學 系

Computer-Aided Design – Fall, 2023

Assignment #2
Due Nov. 8

1. Design with OCTTOOLS

The Octtools are a collection of programs and libraries which together form an environment for IC design. Since we are more interested in the logic level design, we will only discuss those related programs.

2. Tools of Interests

The following tools are used for synthesizing combinational logic.

- Espresso: A two-level Boolean minimizer
- MisII: A multi-level combinational logic optimizer
- Nova, Mustang, Jedi: State assignment tools.
- Sis: A sequential logic optimizer

You use nova for state assignment in sequential circuits design.

The User's Guide and man pages for all these programs can be found along with the source.

3. Using Tools

These are open-source codes and can be download from Berkeley University and compiled under LINUX environment.

All the aforementioned tools have been integrated into sis, so essentially you can just install sis and execute espresso inside sis.

4. Espresso

4.1. Input Specification

Essentially each row in an espresso expression is a product term of a PLA. The document can be found in the package.

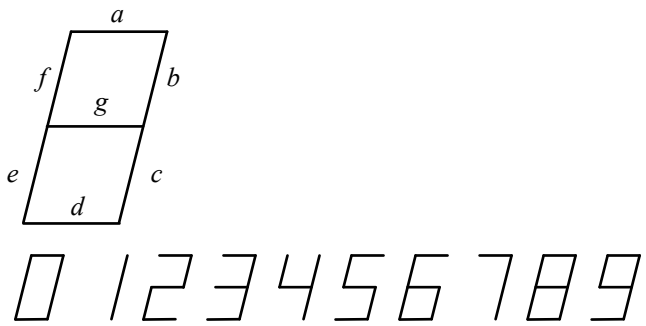
4.2. Running Espresso

Espresso can be run by issuing the command:

espresso [option] [infile] > outfile

4.3. Things to Do

1. Consider the BCD-to-seven-segment decoder shown next.



(a) Use espresso to simplify the two-level implementation of segments e and f. First ignore the Don't-care conditions (i.e., set the outputs to be 0 for input combinations 10 to 15), and then try to exploit the Don't-cares.

(b) Can you get a simpler logic expression than what you get from espresso?

(c) Briefly draw the layout of the PLA.

2. Espresso employs heuristic algorithms to conduct logic simplification; however, most of the time it gives a near-optimal solution. You can also invoke the exact algorithm (namely the QM algorithm) by issuing the following command:

espresso -Dexact [infile] [> outfile]

Use the alu4.pla benchmark, which will be put on the course website along with other PLA benchmarks, to compare both options. First copy that file to your home directory (or any subdirectory, if you want).

Then simplify this circuit with (1) no option, and (2) QM algorithm. Compare (1) the execution time, (2) the size of the PLA.

The execution time can be evaluated as follows. In UNIX, if you want to know the execution time of a given command, you can use the "time" command. For example, if you want to know the time espresso used to simplify a circuit whose name is infile, the following command can be used:

time espresso [infile] ...

The system will response to you with some useful statistics. When you turn in your data, please note which machine you use to prepare your data.