

EE1003 Introduction to Computer I

Bonus Programming Assignment: Logic Minimization

Due Date: 2022/1/18 (Tue.) 23:59:59

NO Late Submission!!!

This is a bonus project. You will have an opportunity to obtain at most 10 points of the semester score by completing this project. However, this is a relatively pretty hard assignment and it may take HUGE of your time. Be sure you have sufficient time if you want to work on this bonus project!!!! Kindly note that even you do not work on this project, no any penalty will be applied to your semester score.

You are asked to implement the Quine-McCluskey and Petrick's Method logic minimization approach by C++. The program reads a non-minimized Boolean function in the AND-OR format. Then, try to use the Quine-McCluskey and Petrick_Method logic minimization approach to optimize the Boolean function as mini as possible. Finally, it outputs the minimized Boolean function in the SOP form.

Input file format: First line describes the variables of input, there may be up to 26 variables (a-z), the second line describes the output of the circuit, the third line describes the Boolean function of the non-minimized function, try to minimize the function.

“!” Means the complement, “*” means AND and “+” means OR.

Output file format: The first two lines are the same as input, and the third line represents the minimized Boolean function.

“!” Means the complement, “*” means and “+” means or.

Algorithm: Try to implement the minimization in Quine-McCluskey and Petrick_Method. You can find all details at the reference video. Try to minimize the Boolean function in least terms. **Make sure the function is equivalence to the original function.**

Requirement: You have to write this program in C++. Your program will be judged with Code::Blocks 20.03 and GNU GCC Compiler (MinGW-W64 project version 8.1.0, 32/64 bit, SHE). We will use C++ 11 standard. You have to submit a source code file (not the entire project) named as StudID_PA_Bonus.cpp (ex: 9862534_PA_Bonus.cpp) and a report named StudID_Name_PA_Bonus_report.pdf (ex: 9862534_陳聿廣_PA_Bonus_report.pdf). Note that the only acceptable report file format is .pdf, no .doc/.docx or other files are acceptable. **BE SURE to**

follow the naming rule mentioned above. Otherwise, your program will be not graded.

Grading

The grading is as follows:

- (1) Correctness of your code: 80%
- (2) Readability of your code: 10%
- (3) The report: 10%

**NO demo session will be held for the bonus project. Please submit your assignment on time.
No late submission is accepted!**

Please do not copy from internet resources, otherwise you will fail the entire course!!!

If you have questions, please E-mail to both me (andygchen@ee.ncu.edu.tw) and TA 金昌明 (abcd29417557@gmail.com)

Example: Below is a sample input file and a sample output file with Boolean function.

Fig. 1 is the input file, Fig. 2 is the output file.

Sample input file:

```
INORDER = a b c d;    //input variables

OUTORDER = output;    //output

output = (!a*!b*!c*!d)+(!a*b*!c*d)+(!a*b*c*!d)+(a*!b*!c*d)+(a*!b*c*d)+(a*b*!c*d)+
(a*b*c*!d)+(a*b*c*d)+(!a*b*c*d)    //non-minimized Boolean function
```

$f(A,B,C,D) = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}CD + \bar{A}B\bar{C}\bar{D} + \bar{A}B\bar{C}D + \bar{A}BC\bar{D} + \bar{A}BCD + A\bar{B}\bar{C}\bar{D} + A\bar{B}\bar{C}D + A\bar{B}C\bar{D} + A\bar{B}CD + AB\bar{C}\bar{D} + AB\bar{C}D + ABC\bar{D} + ABCD$

Fig.1

Sample output file:

INORDER = a b c d;

OUTORDER = output;

output = (!a*!b*!c*!d)+(a*!c*d)+(a*c*!d)+(b*d)+(b*c)

$$f(A, B, C, D) = \overline{A}\overline{B}\overline{C}\overline{D} + A\overline{C}D + A\overline{C}\overline{D} + BD + BC$$

Fig.2

Reference

- [1] Chapter 2 ~ Chapter 8, Paul Deitel and Harvey Deitel, "C++ how to program late objects version," 7th edition, Person 2011.
- [2] Quine-McCluskey and Petrick_Method OCW: https://youtu.be/yv_2O3bp_sg (41:00~1:23:19)
- [3] Quine-McCluskey algorithm:
https://en.wikipedia.org/wiki/Quine%E2%80%93McCluskey_algorithm
- [3] Petrick's Method algorithm:
https://en.wikipedia.org/wiki/Petrick%27s_method