

Logic System Assignment 1

A simple CAD tool based on K-map

Due date:2019/04/12

1. Description

In this homework you will write a program to implement a (2~4-Variable) K-Map simplification process.

The prime implicants and the essential prime implicants of the K-map should be indicated, too.

Finally, your program should show the Minimum SOP (Sum of Product).

2. Requirement

[1] Read the input file

Your program will read the input file for the *minterm* information and *don't care term* information:

$$\text{Eg. } F(A, B, C, D) = \sum m(0,1,5,11,15) + \sum d(4,6,10,14)$$

The format of the information are followed by [File Specification](#).

[2] Initialize the terms in the K-map

You can create one two-dimensional arrays to allocate all the 1, 0, and X (don't care) terms of K-map.

The K-map format is followed by [K-map format and index](#)

Eg. The left-hand diagram, the decimal notation of K Map may be the order of your arrays. Right-hand diagram shows the K Map which is initialized.

AB \ CD	00	01	11	10
00	0	4	12	8
01	1	5	13	9
11	3	7	15	11
10	2	6	14	10

AB \ CD	00	01	11	10
00	1	0	0	1
01	0	1	0	0
11	1	1	1	1
10	1	1	1	1

[3] Write the output file

When the program starts execution, print the initial contents of K-Map at first. After finishing the simplification, print the prime implicants, the essential prime implicants. Eventually, you should use Boolean algebra to show the Minimum SOP as your solution.

3. Input/Output Specification

[1] File Specification

You can finish your program in C, C++, Java, Scala, Python, Matlab, or any other program language.

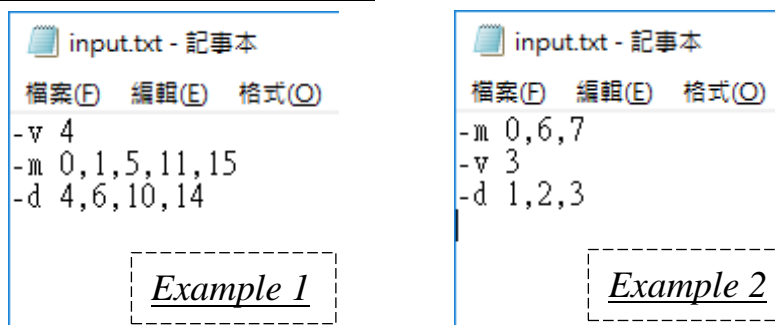
Your program should be compiled as an executable file. (Need to tell TA what OS you use.)

Your program should *read input file*, and put these terms into K-map. After program execution, *output file should be created* to dump the information for the simplification results.

The following is the input/output format example:

(Change the format of input/output is not allowed)

- **Input filename: input.txt**



Three flags in the input file, the order may be changed by user.

-v [number]

Variable number, Range: 2~4

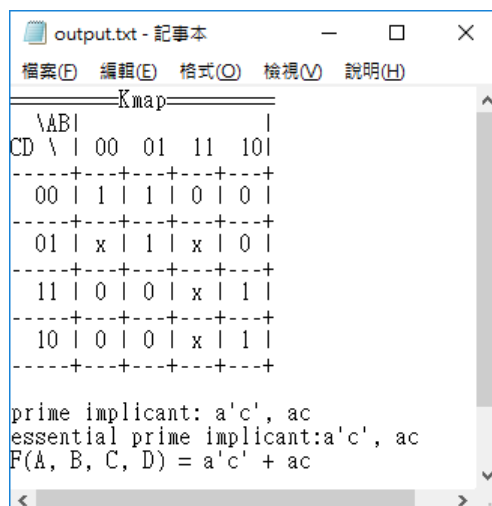
-m [index, index...]

Minterm value index, Range: $0 \sim 2^N - 1$, $N = \text{Variable number}$,
(The existed index stands for value 1)

-d [index, index...]

Don't care index, Range: $0 \sim 2^N - 1$, $N = \text{Variable number}$,
(The existed index stands for value X)

- **Output filename: output.txt**



Your program should create the file like this.

[2] K-map format and index

You can't change the format of K-map output.

4-variable

Output format:

```

output.txt - 記事本
檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)
-----Kmap-----
\AB\
CD \ | 00 01 11 10 |
-----+-----+-----+-----+
00 | 1 | 1 | 0 | 0 |
-----+-----+-----+-----+
01 | x | 1 | x | 0 |
-----+-----+-----+-----+
11 | 0 | 0 | x | 1 |
-----+-----+-----+-----+
10 | 0 | 0 | x | 1 |
-----+-----+-----+-----+

prime implicant: a'c', ac
essential prime implicant:a'c', ac
F(A, B, C, D) = a'c' + ac

```

Index:

AB \ CD	00	01	11	10
00	0	4	12	8
01	1	5	13	9
11	3	7	15	11
10	2	6	14	10

3-variable

Output format:

```

output.txt - 記事本
檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)
-----Kmap-----
\AB\
C \ | 00 01 11 10 |
-----+-----+-----+-----+
0 | 1 | 1 | 0 | 0 |
-----+-----+-----+-----+
1 | x | 1 | x | 0 |
-----+-----+-----+-----+

prime implicant: a'
essential prime implicant:a'
F(A, B, C) = a'

```

Index:

AB \ C	00	01	11	10
0	0	2	6	4
1	1	3	7	5

2-variable

Output format:

```

output.txt - 記事本
檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)
-----Kmap-----
\ A\
B \ | 0 1 |
-----+-----+
0 | 1 | 0 |
-----+-----+
1 | x | 0 |
-----+-----+

prime implicant: a'
essential prime implicant:a'
F(A, B) = a'

```

Index:

A \ B	0	1
0	0	2
1	1	3

4. Hint

You can reference the flow chart below to design your program.

