# Logic System Assignment 1

# A simple CAD tool based on K-map
# Due date: 2016/04/22

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**

    i. **Read the input file**
    Your program will read the input file for the minterm information and don't care information:
    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 Input/Output Specification.

    ii. **Initialize the terms in the K Map, and do the simplification**
    You can create one or two-dimensional arrays to allocate all the terms of K Map. The order should follow the **order in this assignment**.

    iii. **Write the output file**
    When the program starts execution, print the initial contents of K-Map at first. Also, you must print the prime implicants, the essential prime implicants and the boolean algebra to show the Minimum SOP.

## 3. Input/Output Specification
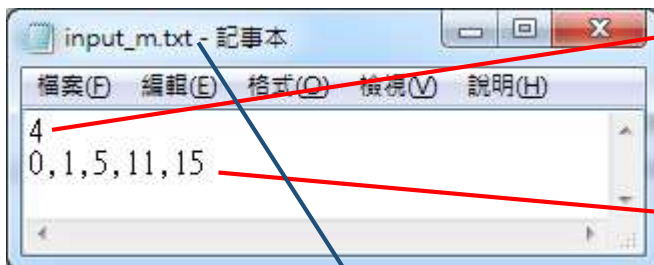
### i. File Specification

You can finish your program in C, C++, or Java.

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.
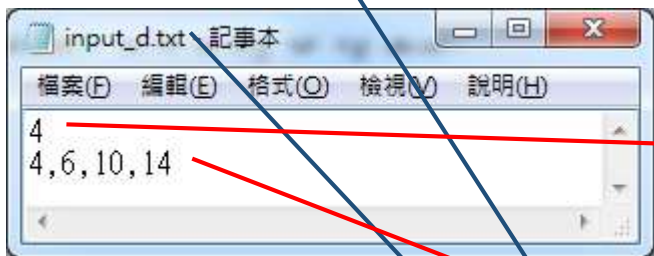
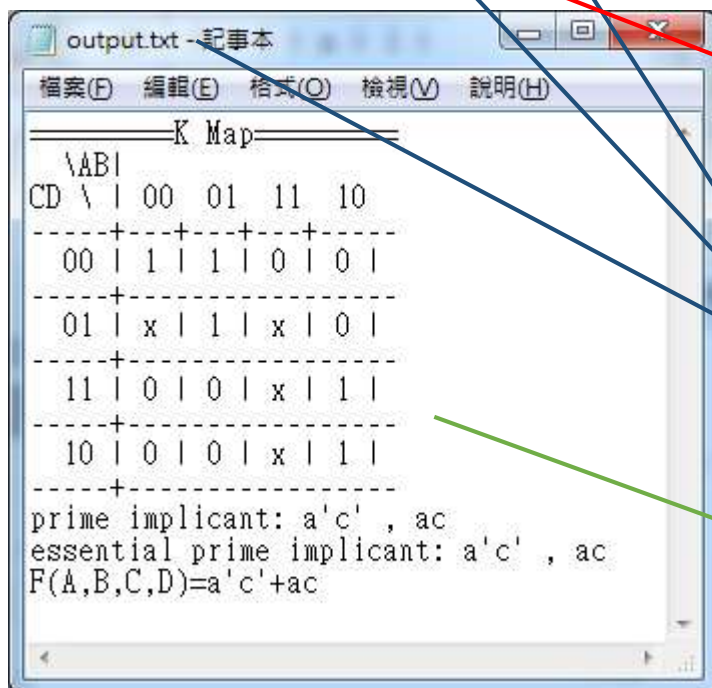**Input: input_m.txt, input_d.txt**

**Output: output.txt**

The following is the input/output format example:

input_m.txt - 記事本
```
檔案(F)  編輯(E)  格式(O)  檢視(V)  說明(H)
4
0,1,5,11,15
```

input_d.txt - 記事本
```
檔案(F)  編輯(E)  格式(O)  檢視(V)  說明(H)
4
4,6,10,14
```

output.txt - 記事本
```
檔案(F)  編輯(E)  格式(O)  檢視(V)  說明(H)
============K Map============
 \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
```

Variable number
Range: 2~4

Midterm value index
Range: 0~15
(The existed index stands for value 1)

Variable number
Range: 2~4

Don't care index
Range: 0~15
(The existed index stands for value x)

The file names are fixed. DO NOT change them.

Your program is expected to create the file including the content.

**ii.    Kmap order ( here not the order from truth table to K map)**

**1.    4 variable**

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

| 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 |

Fig1. The index of minterm          Fig2. Example value of minterm

**2.    3 variable**

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

Fig3. The index of minterm

**3.    2 variable**

| A\C | 0 | 1 |
|---|---|---|
| 0 | 0 | 1 |
| 1 | 2 | 3 |

Fig4. The index of minterm

## 4. Hint

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