Logic System Assignment 1
A simple CAD tool based on K-map

1. Description

In this homework, you will write a program to implement a 4-Variable K Map simplification process, and find the Minimum SOP. Figure 1 shows the flow chart of K Map, and you can refer this flow as your procedure.
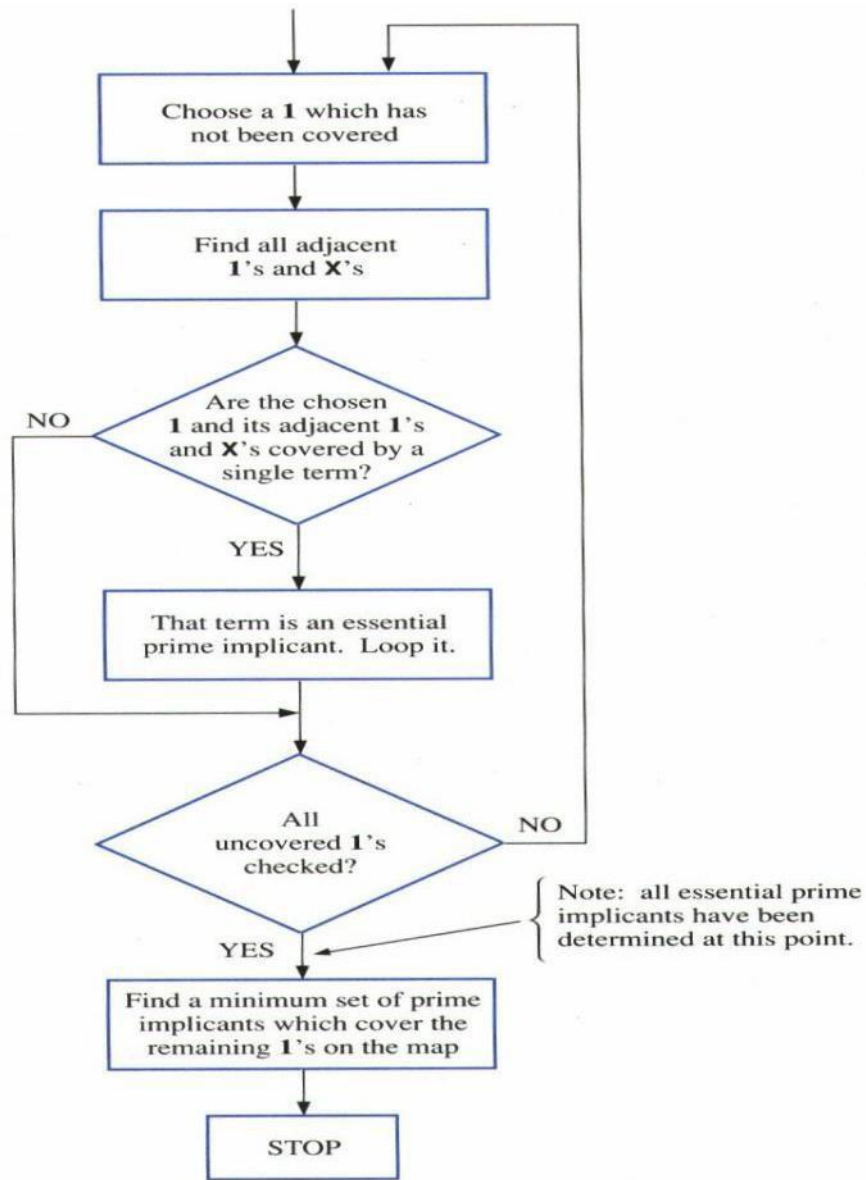

Figure 1. Flow Chart of K Map

2. Requirement

1) Find out all minterms from input

Read input file and get all the minterms. Terms in the input file may not be minterms, so you need to find out all minterms first. For example, you may read terms "a'bc", so you get m6(a'bcd') and m7(a'bcd) of this input.

a'bc → a'bcd' + a'bcd

2) Initialize the terms in the K Map

You can create one or two-dimensional arrays to allocate all the 1, 0, and X (don't care) of K Map. For example, under 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.

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

CD \ AB	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) Program steps

When the program starts execution, print the initial contents of K-Map at first. After finishing the simplification, you must print the decimal notation of terms of each group which you simplify. Eventually, you should use Boolean algebra to show the Minimum SOP as your solution.
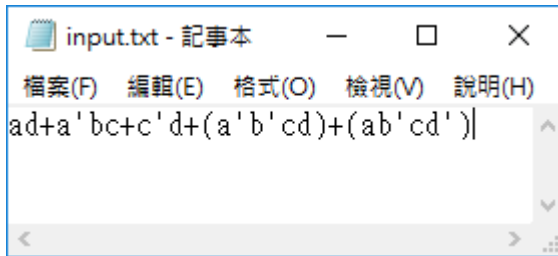
3. Input/Output Specification

Your program should be compiled as an executable file (e.g. KmapSim.exe for win32 environment), and you can finish your program in any language (C, C++, and Java, etc.).

Your program should read input.txt, and put these terms into K-map. After program execution, output.txt should be created to dump the information for the simplification results. The following is the input/output example:

$$F(A,B,C,D) = \sum m(1,5,6,7,9,11,13,15) + \sum d(3,10)$$

The format of input.txt:

ad+a'bc+c'd+(a'b'cd)+(ab'cd')

```
input.txt - 記事本                —    □    ×
檔案(F)  編輯(E)  格式(O)  檢視(V)  說明(H)
ad+a'bc+c'd+(a'b'cd)+(ab'cd')|
```

The format of output.txt:

```
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 | 0 | 0 | 0 | 0 |
-----+---+---+---+---|
  01 | 1 | 1 | 1 | 1 |
-----+---+---+---+---|
  11 | X | 1 | 1 | 1 |
-----+---+---+---+---|
  10 | 0 | 1 | X | 0 |
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group 1: 1, 3, 5, 7, 9, 11, 13, 15
simplification of group 1 -> d
group 2: 6, 7, 10, 11
simplification of group 2 -> bc

F(A,B,C,D) = d + bc
```