



Digital Design I – Project 1

KARNAUGH MAPS

C++

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Program Design Criteria

- For K-maps
 - Instantiated a static 2D array of size 8 with zeros to represent a 3 variable K-map prior to the insertion of any minterms
 - Converted minterms to their 3-bit binary equivalence
 - Used the obtained binary numbers to set conditions for all 8 possible cases

0	1	3	2
4	5	7	6

→

000	001	011	010
100	101	111	110

- Example: Minterms = 0
 - Checks for its corresponding 3-bit binary (000) places 1 in that position in the Kmap
- Since values from 0-7 are now being represented using 3 bits any other number e.g. 8 can be detected easily since they'll need 4 bits for representation
 - This allows for error handling

Boolean Expression

- Based on the Quine-McCluskey algorithm in order to optimize the code in terms of machine readability
- This approach seemed more systematic, which helped with programming and writing code
- Disadvantage: a bit too complex given we're dealing with 3 variables only
- Advantage: can be extended to allow for several more variables

Problems with program – Difficulties during programming – Personal remarks

- Simplifying the Boolean expression was the most challenging part, however it necessitated that we conduct extensive research which expanded our knowledge further
- In order to avoid over-complication some “bad” programming habits were used
 - E.g. Goto statement
- Program is fully commented
 - Very easy to follow

Build/use

- To build: On a unix-based system type the following commands in the terminal
 - `G++ -c -o QM.o QM.cpp`
 - `G++ -c -o main.o main.cpp`
 - `G++ -o final QM.o main.o -lm`
 - `./final`

```
[Youssefs-MacBook-Pro:code yousefkhalifa$ g++ -c -o main.o main.cpp
[Youssefs-MacBook-Pro:code yousefkhalifa$ g++ -o final QM.o main.o -lm
[Youssefs-MacBook-Pro:code yousefkhalifa$ ./final
Enter the minterms [0-7] separated by commas:
0,1,2,3,5

kmap =
  1    1    1    1
  0    1    0    0
F =
  "B'C + A'"
[Youssefs-MacBook-Pro:code yousefkhalifa$ ]
```

- To use: Follow program instructions