

Delivering High Performance Result with Efficient Use of K-Map

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Abstract

The Karnaugh map popularly known as the K-map is a method to simplify a given Boolean expression. The Karnaugh Map (K-Map) based technique breaks down beyond six variable. Telecommunication engineer at Bells lab Maurice Karnaugh refined the works of Edward Veitch and created these k maps. The results are transferred from truth table to the rectangular grid numbering of cells is done according to a special code called Gray code and then assigning the 0s & 1s to the cells of the grids. After that Recognition of the pattern of collecting most number of entries starts. Now write the minimal expression for the required truth table. With the help of k maps one can get a rapid overview of interdisciplinary field in a short time.

Keyword: K-Map, High Performance Result, Mapping, Truth Table, Human Mind Mapping

1. Introduction

The Karnaugh map popularly known as the K-map is a method to simplify a given Boolean expression. It reduces the need of extensive calculations to solve the Boolean equations. It rather uses the ability of humans to recognize the various patterns. Thus it saves the time of the user and eliminates the potential race conditions. The Karnaugh Map (K-Map) based technique breaks down beyond six variable [1]. As Karnaugh mapping uses the ability of the Human mind to distinguish the various patterns and schemas it becomes concretely more trivial to deal with logics of circuits and networks. Also it provides one with concrete information of management procedures and explore the new horizons of this field. Today every aspect of our life needs a solution which is related with the concepts of k mapping.

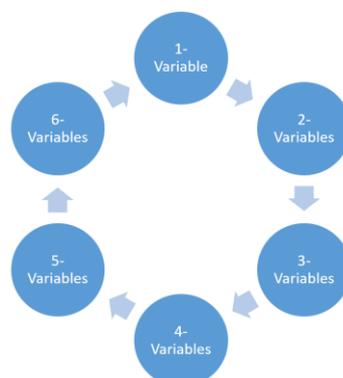


Figure 1. Ranges of K-Map

1.1 Benefits of Using

- Karnaugh maps are making use of the human brain's excellent ability of pattern-matching to decide which terms should be combined to get the simplest expression.
- K-maps allow the quick identification and elimination of potential race hazards, which is something that Boolean equations alone cannot do.
- A Karnaugh map is the best aid for simplification of up to six variables, but with more variables it becomes hard even for human brain to match the optimal patterns.
- For the expressions having involving more than six variables, solving the Boolean expressions is more preferred than the Karnaugh map.
- It has been shown by Sellers, Hsiao and Benson that the Boolean difference can be used for error analysis in logics networks.[4]

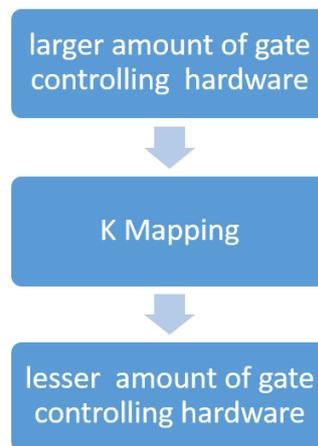


Figure 2. Major Benefit of K map

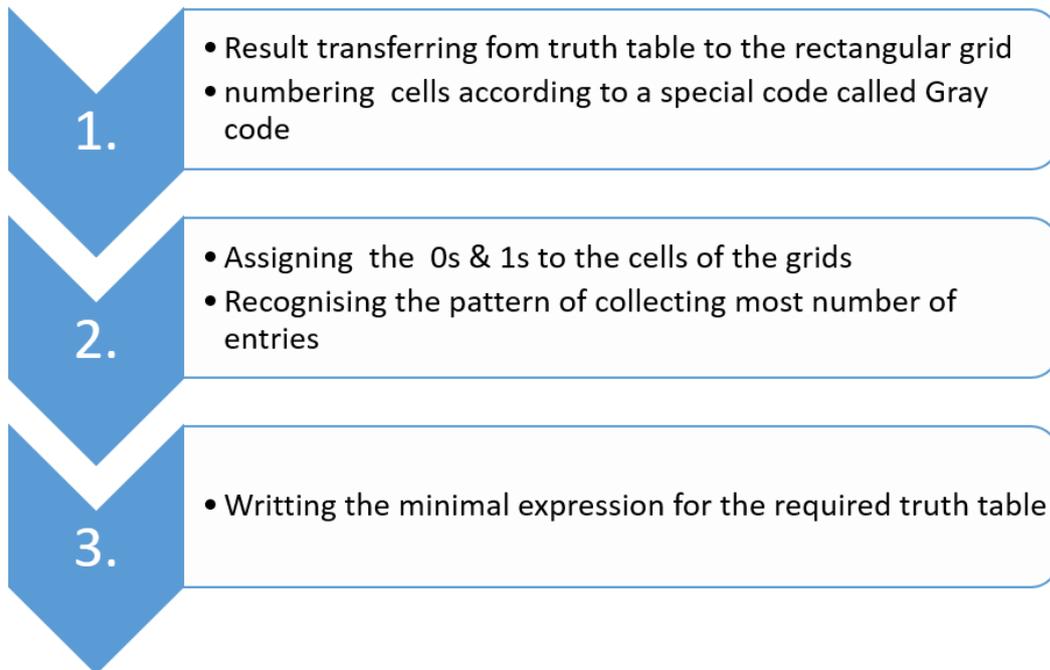
2. History

This study of Boolean algebra was pursued by Edward Veitch in 1952 and was called as Veitch diagram. Later on telecommunication engineer at Bells lab Maurice Karnaugh refined the works of Edward Veitch and created these k maps. As a joint contribution of both the scientists this system of diagrams is also called as K-V map. It is also believed that this concept of K mapping has been existence in several civilizations like Maya, Harappa, Dikjka etc. Traces of k maps show that it was an important tool at that time too.

3. Working

The first procedure utilizes the pictorial nature of the Karnaugh map (K-map)[5]. The results from the required Boolean expression are transferred into a grid of cells from the given truth table. The cells are numbered according to a special code called Gray code . The BRGC(Boolean Relation Gray Code) scheme was initially proposed and patented by Frank Gray in 1953 [6], Now this each cell represents the combination of inputs. The value which will be assigned to a cell will be the corresponding output of the truth table. The tabulation procedure for the determination of prime implicants [7]. The generalized Gray map is a mapping from Z^2 onto the Reed-Muller code of order 1, $R(1; k 0 1)$ [8]. The Gray code mapping has an advantage that two -bit symbols corresponding to adjacent symbols differ in only a single bit [9]. We consider a generalization of PSK with Karnaugh map styled Gray mapping [10] An optimal amount of zeroes and ones (0&1s) are recognized by the user. This represents the tabular form of the results of the original truth table. Now these terms derived as the address of the cells are used to write the minimal expression for the Boolean algebra expression for the required logic. . In the regard of the context of logical designing, a sum of products expression is a minimal

expression only and only if there exists (1) no other equivalent expression involving fewer gates [3]. They have got a greater significance in the physical world as the minimal expressions of the bigger logics is obtained hence there is need of minimum number of gates which leads to saving of money as well as space.



Technically we are implementing the sum of products (SOP) using AND gates fed into the OR gate and product of sums (POS) implementing OR gates fed into AND gate. The logical product of all the above constraint expressions becomes the solution to the TSP. [10].

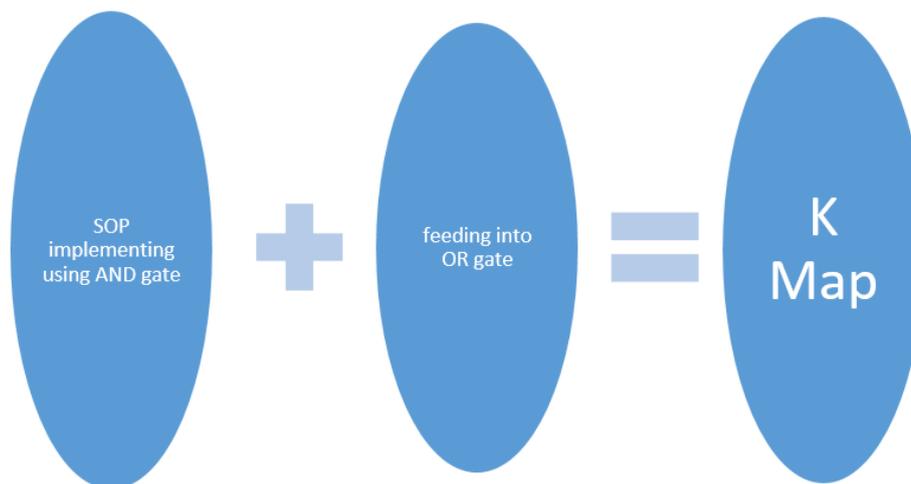


Figure 3.Using SOP in K Map

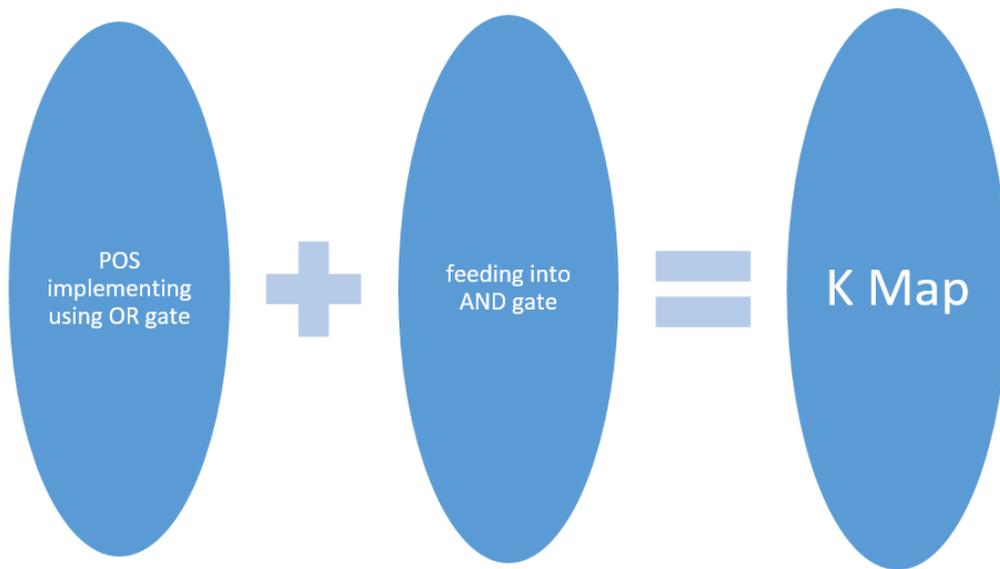


Figure 4. Using POS in K Map

Given below are the examples of 2 bit Karnaugh mapping system that will allow you to understand how does it works.

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4. Conclusion

We have introduced Karnaugh map as an powerful entity to solve the digital, circuital and networking logics.

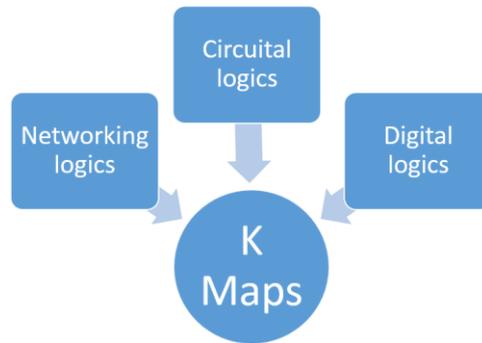


Figure 5. Fields of Efficiency of K maps

As Karnaugh mapping uses the ability of the Human mind to distinguish the various patterns and schemas it becomes concretely more trivial to deal with logics of circuits and networks. Also it provides one with concrete information of management procedures and explores the new horizons of this field. With the help of k maps one can get a rapid overview of interdisciplinary field in a short time. It visualizes the cases which cause the triggering of important questions and solutions to them. It gives ROI approaches to a user making him or her more active in management work.

5. Future Scope

This tool of K mapping is very helpful for creating the artificially intelligent robots as this concept of K mapping uses the ability of human mind to recognize the various patterns. More over this concept can be applied to control the mind maps of animals like apes, monkeys, donkeys. This applicability of K mapping can be more enhanced and one day we will have genetically modified animals as mode of transportations instead of automobiles. We are planning to open a research lab for K maps in North Pole to study the behavior of penguin and polar bear movement.

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