The principle advantage of the use of micro-programming to implement a control unit is that it combines control signals into control words, where each bit of the micro-instruction is dedicated to a specific control line. The other variant, horizontal microprogramming, does not have this feature.

From the 1940s to the late 1970s, a large portion of programming was done in assembly language. Consequently, each horizontal microinstruction is wider (contains more bits). The nano-programming concept was first used in QM-1. A nano instruction can therefore be called horizontal. A horizontal micro-programming concept is:

A. does not require use of signal decoders.
B. results in larger sized microinstructions than vertical microprogramming.
C. better suited for complex operations.

Horizontal microinstructions:

- To control complex operations
- Called micro-programming or firmware
- Microinstructions use encoding of control information
- Horizontal micro-instruction diagram

CPU Control. CHAPTER 1 - INTRODUCTION TO MICROPROGRAMMING CONCEPTS

CHAPTER 6 - COMPUTERS WITH HORIZONTAL MICROINSTRUCTIONS. Also, the set of microinstructions (a micro routine) performs a group of operations to execute the respective instruction. Horizontal microprogramming:

- The purpose of microinstruction executions is to generate a control signal to execute.
- Every bit in the control field attaches to a control line in the horizontal microprogram.
- Control memory is divided into eight 128-word sections within the current nano instruction or an address from a micro instruction operation code.

Summary: Microprogramming is a technique to implement the control logic necessary for the computer to execute instructions. Horizontal microprogramming:

- A. does not require use of signal decoders.
- B. results in larger sized microinstructions than vertical microprogramming.
- C. better suited for complex operations.

The task of microinstruction sequencing is done by addressing the control memory so that a microinstruction may be read.
A combination of vertical and horizontal instructions. E.g., MAR (PC) n control signals encoded into log₂ n bits monitoring, detection, isolation, error repair. User tailoring.


Microinstruction with next address field, pre-fetching microinstructions, concept of horizontal and vertical microprogramming.

III. Memory: Basic concept. in parallel, resembling VLIW instructions or horizontal microinstructions. by programming cells and connections on a programmable integrated circuit. Micro Instruction formats.


Introduction to Programming –Modular Programming, Object Oriented Option Button, Combo Box, List Box, Horizontal Scrollbar, Vertical Scrollbar.

µPC is incremented every time a new microinstruction is fetched from microprogram memory except in following single microinstruction is called a horizontal. Change programming counter to point to the next instruction, Determine the type of the instruction. Think of it as the amount of time required to perform one micro-instruction. If a micro instruction may finish in a shorter time than a clock cycle, then the next micro instruction has to wait. Horizontal graph of word length.

Unit-IV Programming: Assembly language programming based on intel 8085/8086. Microinstructions, concept of horizontal and vertical microprogramming. The concept of microprogramming was first proposed by W. V. Wilkes in 1951. The horizontal microinstruction mechanism provides long microinstructions. Each control word in the control memory represents a microinstruction, and it executes one or more micro-operations. (horizontal micro programming)

Debugging Experience with some high level programming language c) Microinstruction format - horizontal vs. vertical d) Microcontrollers. Mirager, the “Best-Yet” Approach for Horizontal Microprogramming. Robert K. Clark, Argonne each microinstruction executing several nonconflicting primitive. Vertical “Horizontal” Microcode. µseq µaddr A-mux B-mux bus enables register enables. • Control field for each “Vertical” Microcode • Compact microinstruction format for each class of µ-operation. 2 pages Multiprogramming/Exceptions.