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BEKER'S ALGORITHM: AN EFFICIENT AND IMPROVED ARCHITECTURE OF DAA INSTRUCTION FOR DECIMAL CONVERSION IN 8085 µP

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Abstract: *Now a days so many clients are using 8085 simulators and real time programming platforms for educational and research applications. The beker's algorithm presented an enhanced architecture for DAA Decimal Adjust Accumulator instruction in 8085 microprocessor. To represent the processed data it is necessary to convert the hexadecimal data to BCD format after the arithmetic instructions. The DAA instruction does not offer a persistent and error free operation. The proposed algorithm corrected all these types of bugs and offers 100% precise result on arithmetic operations.*

Key words: *DAA, Lab VIEW, Microprocessor, Graphical programming, BCD Conversion.*

I. INTRODUCTION

The Intel's 8085 is a Von Neumann design based 8 bit microprocessor introduced in 1977.The processor has seven 8-bit registers accessible to the programmer, named A, B, C, D, E, H, and L where A is the 8-bit accumulator and the other six can be used as independent byte-registers or as three 16- bit register pairs, BC, DE, and HL. The DAA instruction work only after the arithmetic operations and the functionality is explained below.

The contents of the accumulator are changed from a binary value to two 4-bit Binary Coded Decimal (BCD) digits. This is the only instruction that uses the Auxiliary flag to perform the binary to BCD conversion; the conversion procedure is described below.

1. If the value of the low-order 4-bits in the accumulator is greater than 9 or if Auxilary Carry flag is set, the instruction adds 6_d to the low-order four bits.
2. If the value of the high-order 4-bits in the Accumulator is greater than 9 or if the Carry flag is set, the instruction adds 6_d to the high-order four bits.

While doing the high value arithmetic operation there must be a bug existing *ie,* for example the addition of $1C_h$ and 14_h the result will displays 42_d after DAA instruction, there must be some conversions are missing because, the DAA only ensure for the above two conditions. The proposed algorithm will solve all these bugs and offer 100% precise result on BCD conversion. The algorithm is designed and tested in Lab VIEW graphical programming platform. The exe file created by the algorithm is fused to the FPGA and verified the accuracy and efficiency also.

II. BEKER'S ALGORITHM: IMPLEMENTATION.

The algorithm will work through the following steps,

1. Compute the Hexadecimal sum of the numbers using arithmetic instruction in 8085.
2. Break up the digits of the results in to two nibbles.
3. Do the conversion of Hex to BCD for the number of times by the left most digits by adding 6_d repeatedly.
4. The resultant value should be equal to the
   Decimal equivalent of Hex sum.

The internal environment of 8085 ALU is simulated by using graphical programming. The Hex input from the user is summed by using the numeric adder, and applied to the decimal to binary converter. The binary converter is designed as a sub VI and result is sub grouped in to lower order four bits and higher orders four bits. The

lower nibbles are same as the AL register and higher nibbles are same as for AH register.

The algorithm will check the status of both registers and do the operations discussed above.

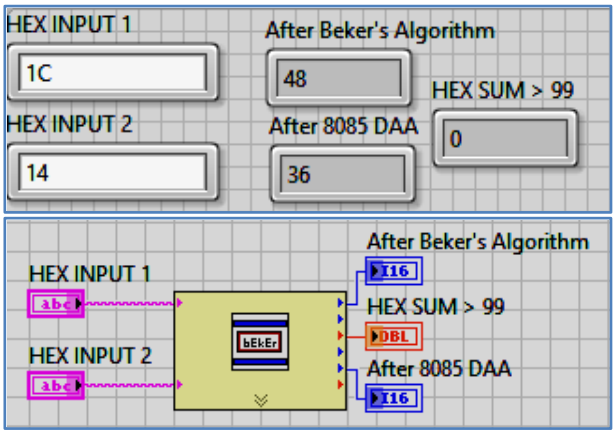

Fig. 01 Front panel and Block diagram window of algorithm.

After the addition operation the Accumulator should contain the binary 0011 0000 equivalent to the hex vale 30. During the binary addition with $1C_h$ and 14_h the Auxilary Carry is generated. By the application of DAA instruction, the accumulator is summed with 06h and we can obtain the output as 36_d in place of the BCD sum 48_d. *ie* some conversions are missing in DAA procedure. Now the upper nibble of accumulator is 0011 equivalent to 03_d. The proposed algorithm overcomes this situation by the conversion of binary to BCD for the three times indicated by the left most digits by adding 06_d repeatedly.

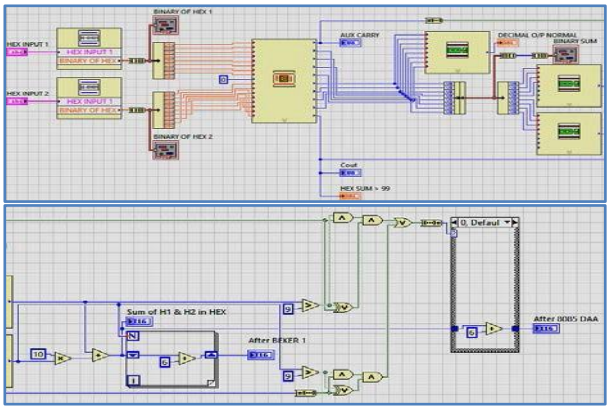

Fig. 02 Block diagram window of Beker's algorithm using Lab VIEW.

III. CONCLUSION.

The Intel's DAA instruction in 8085 µp does not offer a precise and error free operation. The proposed algorithm overcome all these types of bugs and offers 100% precise result on arithmetic operations. By comparing the DAA procedure and beker's algorithm, it offers reduced memory utilisation and accurate results on BCD conversions.

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