**General Operation**

This program was developed to design a digital clock with assembly language on Intel 8086 architecture with 7 segment displays. The program consists of 4 main sections: Clock Operation, Displaying Seconds, Minutes, and Hours, Clock Setting, Modifying Minutes and Hours. The Clock Operation section is the part that controls the general operation of the watch. Displaying Seconds, Minutes, and Hours section is for printing second, minute and hour values in 2 decimal base on 7 segment displays. The Clock setting section and the Modifying Minutes and Hours sections work together; thanks to these sections, the user can adjust the time by increasing or decreasing the hours and minutes. Finally, if this program wants to be run in a physical circuit, the frequency of the clock signal given to the Intel 8086 processor must be adjusted to once per second.

**Initialization and Initial Value Assignments**

At the beginning of the program, zero values are assigned to the memory addresses associated with the processor. The memory addresses are defined as 0300h, 0304h, and 0308h. After Initialization, the program call the display labels as **SECOND, MINUTE, HOUR**.

**Clock Operation**

This part of the program controls the relative increment of second, minute and hour values. When the second reaches 59, it becomes zero again and the minute is increased by one unit. Likewise, when the minute reaches 59, it becomes zero again and the hour is increased by one unit. and finally, after 23 o'clock, it becomes zero again instead of 24 o'clock. In addition, in this part of the program, the user's time setting status is checked with the user input received from address 2084h. Finally, the indicators are updated by calling the SECOND, MINUTE, HOUR tags with the CALL command.

**Displaying Seconds, Minutes, and Hours**

Displaying Seconds, Minutes, and Hours

This section contains the operations required to display seconds, minutes and hours on a 7 segment display.

SECOND Label:

The "SECOND" label retrieves the value of the second from memory, divides it to find the decimal ones and tens digit. It then converts these values into binary codes suitable for the seven-segment display and writes them to the output ports to display the seconds.

MINUTE Label:

The "MINUTES" label is responsible for retrieving the minute value from memory, dividing it and finding the ones and tens places in decimal base. It then converts these values into binary codes suitable for the seven-segment display and writes them to the output ports, displaying the minutes.

HOUR Label:

Similarly, the "HOUR" label retrieves the hour value from memory, divides it to find the ones and tens digits in decimal base, and converts these values to the binary codes suitable for the seven-segment display. Then, it writes them to the output ports, displaying the hours.

Generating Seven-Segment Binary Codes

In the "Generating Seven-Segment Binary Codes" section, the program determines the binary codes needed to display numbers on a seven-segment display. Each numeral or digit has a corresponding binary code that controls which segments of the display will light up to represent that numeral. The program calculates these binary codes based on the numeral to be displayed, ensuring the correct representation of numbers on the display.

**Clock Setting:**

The SET label is used to adjust the clock settings. When the set switch is activated, the program enters a mode where users can modify time settings such as minutes and hours. The label checks the status of the set switch to determine if the clock should enter the setting mode.

Switch Status Check:

The program checks the status of the set switch.

If the set switch is closed, it jumps to the SECOND\_ZERO label to resume normal clock operation.

Interrupt Handling:

If the set switch is open, the program waits for keyboard inputs.

Keyboard input triggers specific operations to increment or decrement minutes and hours.

Switch Status Check Again:

After completing the necessary operations, the program checks the status of the set switch again.

If the set switch is still open, it returns to continue the clock setting mode.

This process allows users to adjust minutes and hours using keyboard inputs while the set switch is activated.

**Modifying Minutes and Hours**

This section enables users to adjust minutes and hours as needed in clock setting mode. By providing functions for increasing and decreasing minutes and hours separately, it ensures precise control over the displayed time.

Decreasing Minutes (DEC\_MIN): It checks if the current minute value is 0. If the minutes are already at 0, it sets the minute value to 59 and updates the display. Otherwise, it decrements the minute value by 1, updates the display, and proceeds to the setting label.

Increasing Minutes (INC\_MIN): It checks if the current minute value is 59. If the minutes are already at 59, it sets the minute value to 0 and updates the display. Otherwise, it increments the minute value by 1, updates the display, and proceeds to the setting label.

Decreasing Hours (DEC\_HOUR): It checks if the current hour value is 0. If the hours are already at 0, it sets the hour value to 23 and updates the display. Otherwise, it decrements the hour value by 1, updates the display, and proceeds to the setting label.

Increasing Hours (INC\_HOUR): It checks if the current hour value is 23. If the hours are already at 23, it sets the hour value to 0 and updates the display. Otherwise, it increments the hour value by 1, updates the display, and proceeds to the setting label.

Resetting Seconds (SECOND\_ZERO): It sets the second value to 0, updates the display, and returns to the beginning label to restart the clock loop.

This section simplifies the adjustment of minutes and hours, ensuring accurate control over the displayed time.