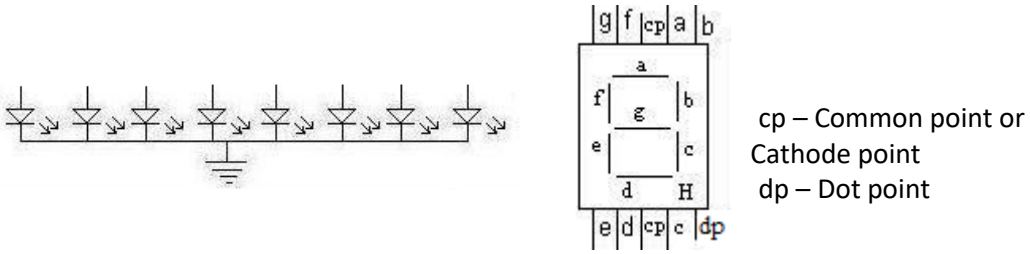
Experiment 3: Real Time Clock with Stop Watch
Time: 2 days

a) Connect one 7-segment display [common-cathode] to 8255 port (J3/J7) through 74245 and resistor.
(Use individual current limiting resistor for every segment.)
Display 0 to 9 continually with 7 -segment display with 1 second digit display time.



Internal circuit and PIN configuration of Common Cathode 7-segment display

b) Count 00 to 06, 15 to 23, 29, 47 to 54 continually with two 7-segment displays with 0.5 second digit display time.
(Segments of two displays are to be connected in parallel and driven by one 74245 and one port of 8255) and common points (common cathode pin) of each display are to be driven by another port of 8255 through another 74245).

c) Design a digital clock using common-cathode 7-segment display modules and a mode switch. The clock normally displays the time in hh-mm-ss format. It updates time automatically using the timer interrupt of the microcontroller. On pressing the mode switch, the display changes to stopwatch mode in hh-mm-ss format. In stopwatch mode there are two more buttons – start and stop. The start button starts the stopwatch resetting it to zero, stop button stops the stopwatch. It should be noted that in the stopwatch mode, both normal clock and stopwatch clock get updated with timer interrupt. This ensures that the normal time also gets updated during the run of stopwatch. On pressing the mode button once more, the display returns to show clock time.

Points to note:
• The interfacing of display modules and switch be done through 8255 ports (J3/J7).
• Learn about 8255 programming.
• For the kit, look into the manual and find out the port addresses.
• Identify the patterns to be output to the ports for displaying digits.
• The time values are to be stored at location 9000H for hour, 9001H for minute and 9002H for second in a 24-hour format. Similarly, the stopwatch values are to be stored at location 9003H for hour, 9004H for minute and 9005H for second in 24-hour format.
• The program should have an interrupt service routine that updates the time after every 1 second. Learn about installation of ISR properly.
• Main program, after initialization of ISR, should work in a loop, looking for the pressing of switch. The display mode is selected accordingly. It then displays either the clock time or stopwatch.