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**INTRODUCTION**

* In an increasingly digital world, the ubiquitous presence of clocks and timekeeping devices cannot be overstated. From the humble alarm clock by our bedside to the synchronized time systems that govern our daily lives, the importance of accurate timekeeping cannot be underestimated. This report delves into the realm of digital clock simulation, focusing on the utilization of counters as a fundamental component in the creation of digital timekeeping systems.

The concept of a digital clock may seem commonplace, but beneath its simple facade lies a complex interplay of digital electronics and mathematical precision. This report aims to provide an in-depth exploration of the design, simulation, and functionality of digital clocks built upon counter circuits. By understanding the inner workings of these systems, we gain valuable insights into not only the core principles of timekeeping but also the broader field of digital electronics and its applications.

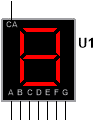
Throughout this report, we will embark on a journey through the fundamental theory of digital counters, their application in clock circuits, and the intricacies of clock signal generation. We will explore the various types of counters, such as binary counters and decade counters, and how they contribute to the accurate representation of time in a digital format.

By the end of this report, readers will have a comprehensive understanding of how digital clocks, driven by counter circuits, function and can be simulated for testing and validation. This knowledge not only serves as a valuable educational resource but also as a foundation for anyone interested in the fascinating world of digital electronics and timekeeping technology.

**7-Segment Display**

* A **7-Segment Display** consist of seven individual colored LED’s (called the segments), within one single display package in order to produce the required numbers or HEX characters from 0 to 9 and A to F respectively. A standard 7-segment LED display generally has eight (8) input connections, one for each LED segment and one that acts as a common terminal or connection for all the internal display segments. Some single displays have also have an additional input pin to display a decimal point in their lower right or left hand corner. One or more such display are combined to display bigger numbers. This kind of display is generally used in digital clocks, calculators, wrist watches and many more electronic devices.

**Following is the segment of 7-segment display:**



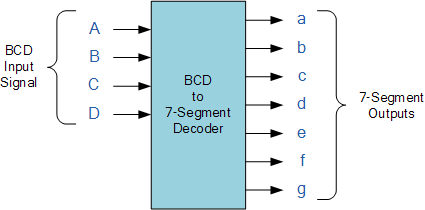
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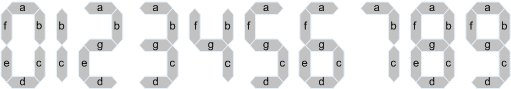
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7-Segment Display Elements for all Numbers: 

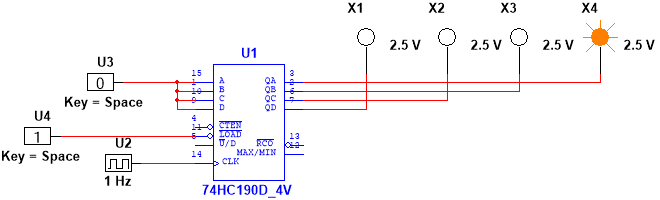
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**#MOD-10 counter (Decade counter)** – A decade counter is a series type of digital counter which is designed to count ten digits. It performs the operation of resetting automatically when there is a new clock input signal. As the counter counts **ten unique combinations** of the applied input, it is termed a decade counter.

The values that a BCD counter counts are 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 in binary format. The counter which we used is 74HC190 which is a synchronous decade counter. In this counter IC A, B, C and D are load inputs which are connected to the individual flip-flops onside the counter, QB, QC and QD are the individual binary outputs representing the current count state in a four bit binary format.

CTEN is count enable, LOAD is used to whether enable or disable the counting, U’/D decides mode of counter whether it is up/down counter, CLK is clock signal, RCO is ripple clock output which can be used to cascade multiple counters as it serves as a way to signal when the counter is about to wrap around its maximum or minimum value and MAX/MIN output produces high pulse when the terminal the terminal count nine (1001) is reached in UP mode and count zero (0000) is reached in down mode.

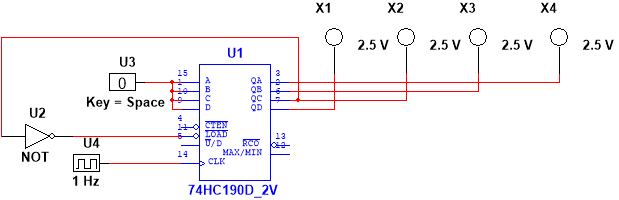
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**#MOD-6 counter** –A modulo 6 (MOD-6) counter circuit can be made using a decade counter and feeding the NANDed output of QB and QC to the load so that whenever the count reaches **0110** i.e. 6 in decimal the count starts again from **0000** i.e. 0 in decimal.



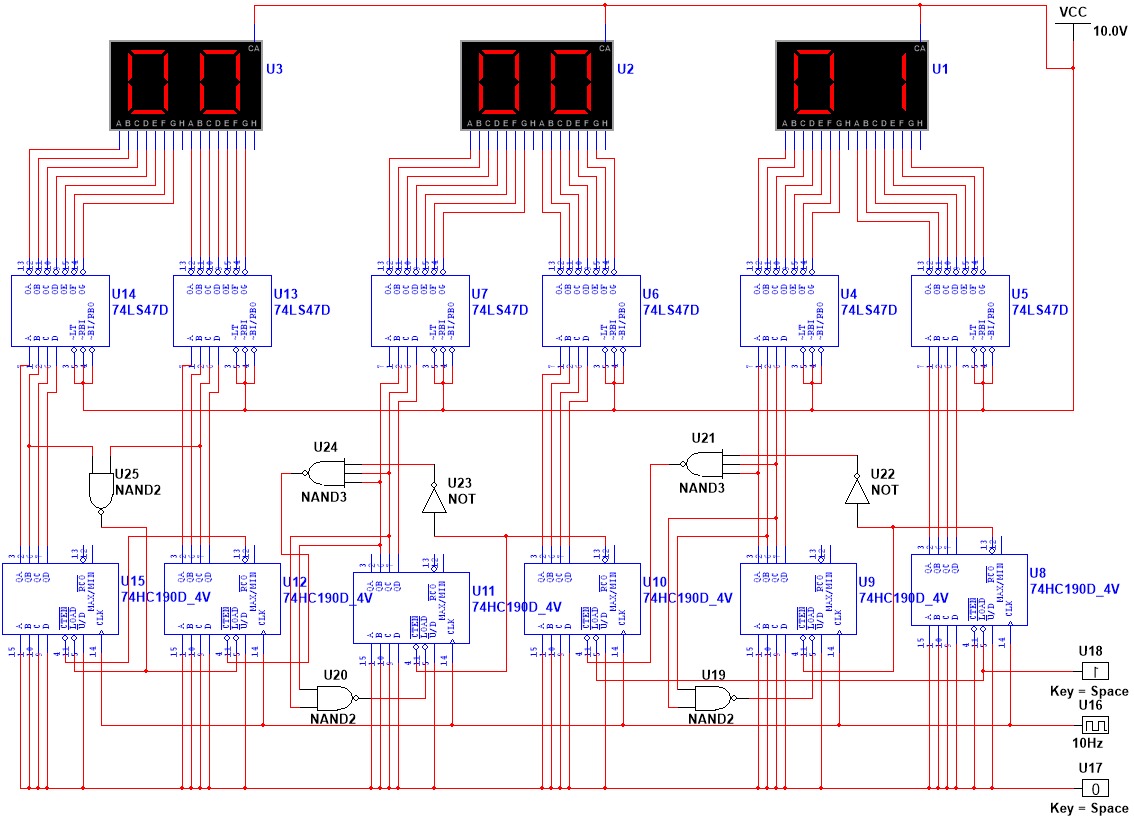
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**WORKING MECHANISM**

* With the help of 7-segment display, BCD to 7-segment display decoder and counters we can simulate a digital clock as shown in figure below;



Here all together we need 6 displays so the working process is divided into six steps;

**STEP 1:** At first we setup first counter i.e. decade counter such that it counts 0-9 every second by providing clock signal with 1 Hz frequency, LOAD inputs A, B, C and D with low voltage (0), with high voltage (1) and with (0).

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* At last by combining all counters, decoders and displays a simulation of digital clock of 24 hour format is completed. Since the version of simulation tool i.e. multisim was old so due to some bugs we had to set frequency of the clock 10 Hz to change the count of counter by 1 secound.

**FARWESTERN UNIVERSITY**

**Mahendranagar, Kanchanpur**

**Digital Clock**

**Project Report**

**Submitted To:**

**Er. Kamal Lekhak**

**Assistant Professor**

**Far-Western University**

**Submission Date:** 2080/06/09

**Submitted By:**

* **Mukesh Pant(29)**
* **Adarsh Joshi(2)**
* **Anil Chandra Giri(3)**
* **Dinesh Prasad Joshi (18)**

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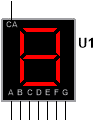
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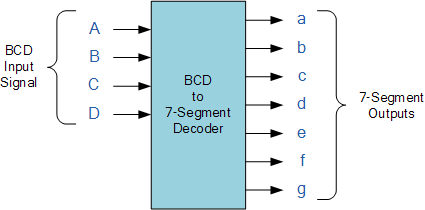
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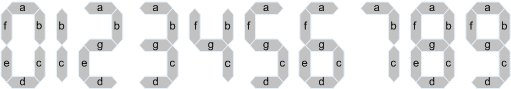
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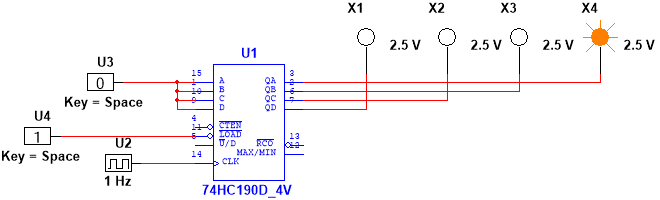
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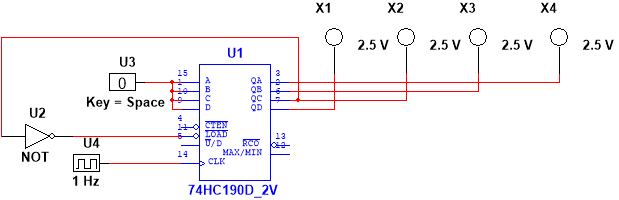
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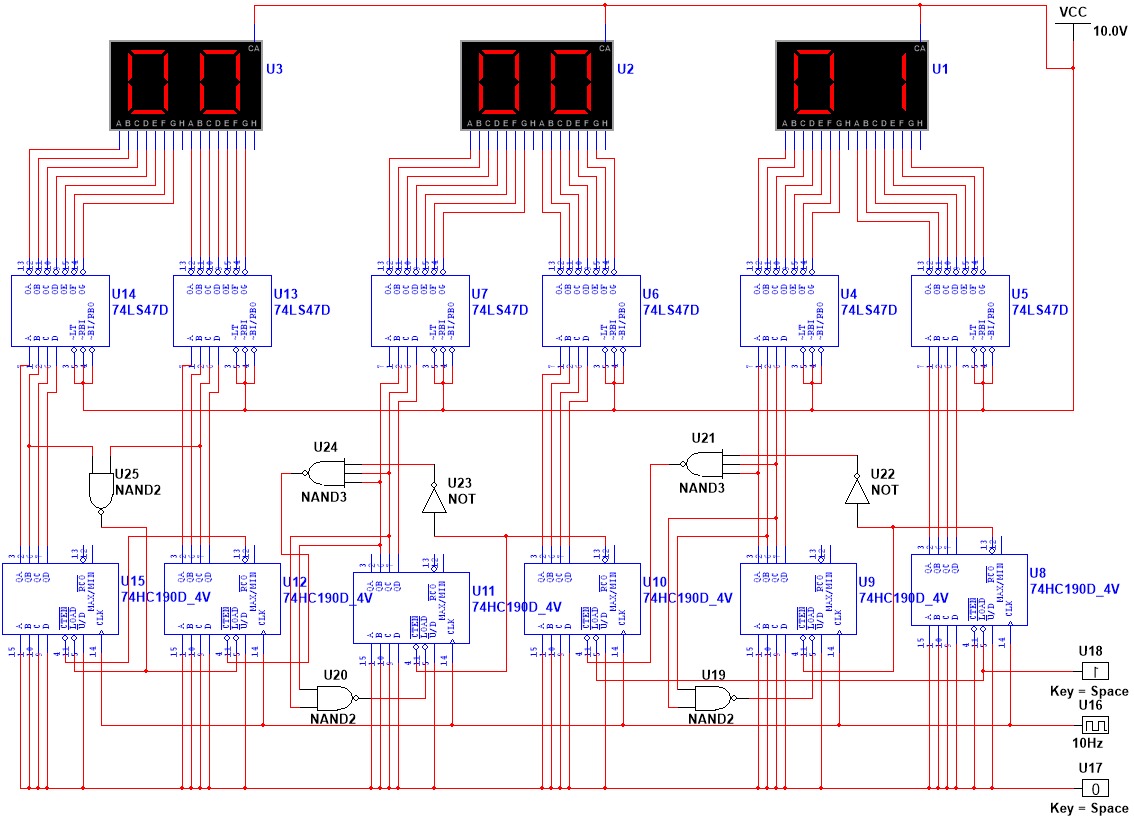
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