# 3C8 Project – Dice Mini-Project

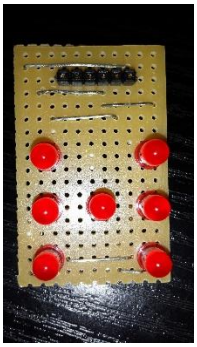
## Aims:

- To design, simulate and build a very simple digital logic system.
- To familiarize you with setting up LEDs.
- Use of Multisim to draw and simulate digital circuits.
- Write a report

## Overview

In this session, you are going to:

Design, simulate & construct a dice circuit using 7-LEDs set out in a dice pattern.



Your circuit should be built on a breadboard using its 5V power supply.
Use integrated circuits from the CMOS CD4000 series of logic devices.

## Specification

The circuit should implement a random throw of a dice each time that the user presses a button or switch. Use a counter with 6 states and provide a binary count on 3 of its outputs. These outputs are decoded with additional gates in order to control the LED display correctly. The switch is pressed at any time during the count and this halts the counter at a random.

## Procedure

The counter of interest to us is the CD4029 – an up/down, pre-settable, binary/decimal device and powered from a 5V supply on a breadboard. Advance this counter with a 5V clock signal using a signal generator. The 3 counter outputs are in turn used by some gates to control the set of 7 LEDs. We shall call these gates a 'decoder' circuit. Thus, include some additional CMOS simple logic gates to decode the counter signals for the display e.g. AND gates (CD4081), OR gates (CD4071), NOR gates (CD4001), NAND gates in CD4011, from the CMOS family of ICs.

## Guidelines

Divide up the various tasks among the members of your group.

Determine which dice you are using. There are 3 types.

Work out a suitable solution for your dice circuit:

a) by drawing a block diagram of the entire circuit
b) design a way to force the counter to count only 6 states. Would any 6 states work?
c) by writing down a truth-table of Counter outputs and Dice signals required
d) by simulating your circuit in Multisim

Show your proposed circuit to the demonstrator **BEFORE** constructing it.

Design an Arduino program or Verilog testbench that will allow you to test the constructed circuit, and to test the outputs of the counter and LED logic individually.

Finally, when your circuit is working successfully, consider how you might go about solving the dice problem with just an Arduino micro that drives the 7 LEDs directly.

## Report

In your final report you should include a description of the dice mini-project. This means providing a few pages with a block diagram, a circuit, and a description of the problem and its solution.