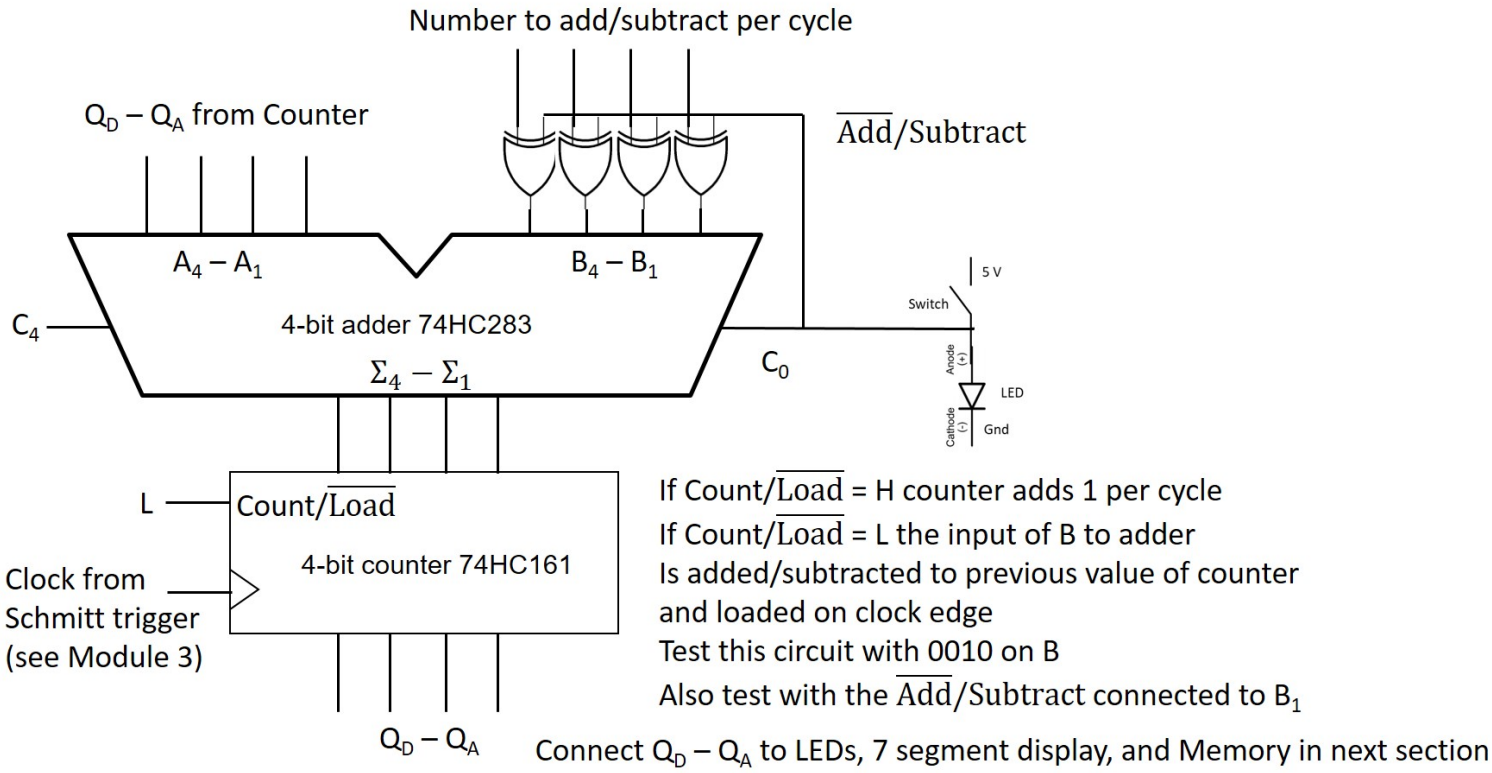
Labs for Module 4

Preparation: Connect the 4-bit counter and adder (updated!)

- Connect the 74HC161 4 bit counter, 74HC86 XOR and the 74HC283 4-bit full adder as the figure shows
- Connect a Schmitt trigger clock from Module 3 to the Clock input
- Pin 1, 7, and 10 of the 74HC161 should be connected to 5 V. Connect pin 9 to 0 V to load from adder.
- Try counting +1, +2, +3 etc



Preparation: Connect the 7-segment display

- Connect the 7 Segment Display to the CD4543B 7 Segment Decoder.

  Segment “a” to “a”, “b” to “b” etc. Connect pin 3 or 8 on the display to GND.

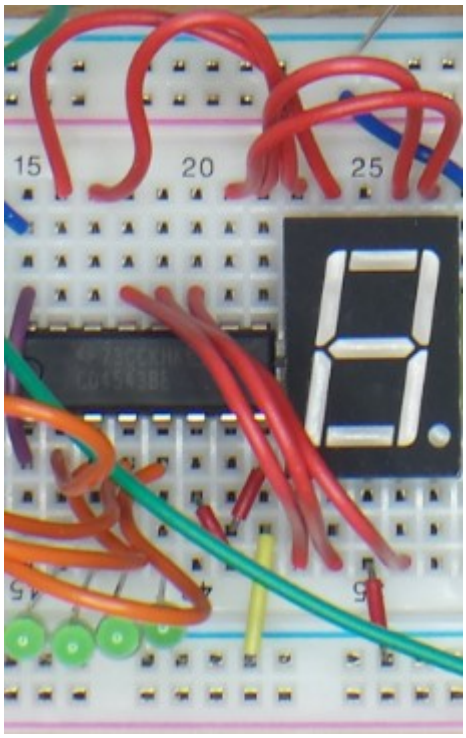
- On the CD4543B The D_D input is MSB and D_A is LSB.

  Pin 6 and 7 should be GND, but pin 1 “Latch” should be high.

  Note: the current is limited by the CD4543B so no series resistors are needed in this connection, but do not connect the LEDs in the 7-segment display without resistors otherwise or they will die.

- For inputs on D_D D_C D_B D_A > 1001 (9) the display will be blank.

- Use the 74HC161 to test the display.



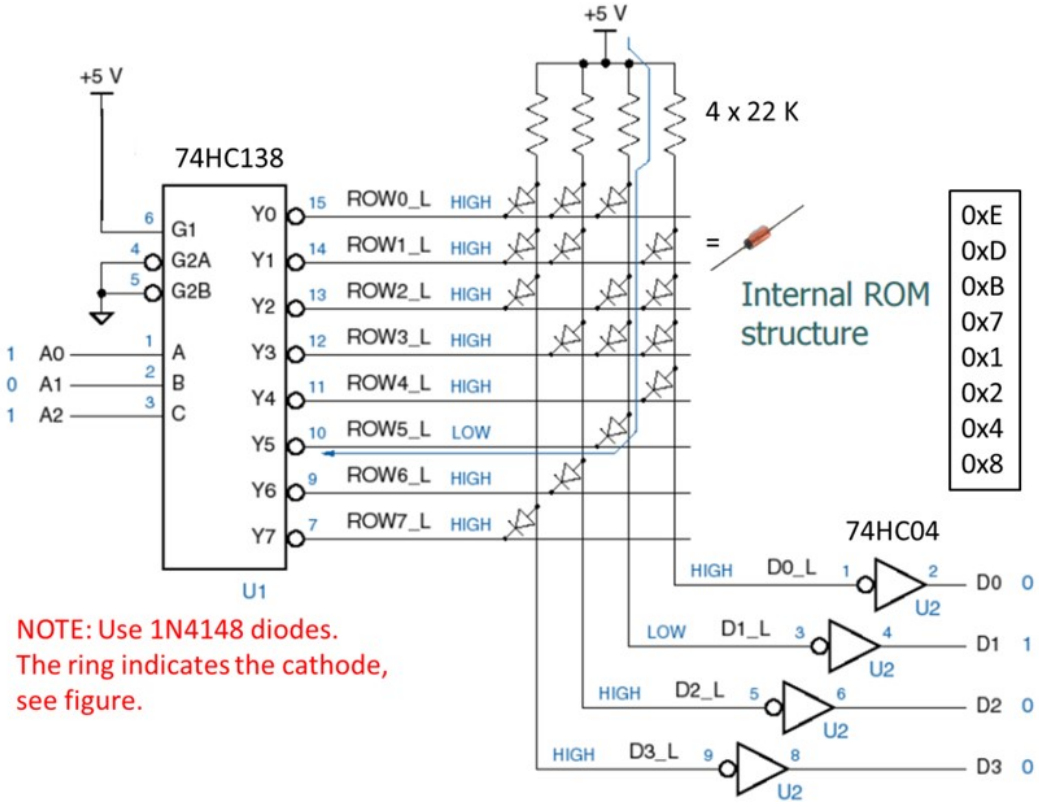
Module 4 task to report in the written Lab Report and demonstrate

The 74HC138 activates one of its eight outputs “0” at a time, the other outputs are “1”.

You must connect a 74HC161 to the select inputs of the 74HC138 for this lab to pass.

The diodes and the resistor will operate as an AND gate, so a diode will result in a “0”.
However, after the inverter, this is a “1”, so a Diode represents a “1”. See the example.
Either 10 k or 22 k resistors can be used, the value is not critical.
Check polarity of diodes!

- Connect a Diode ROM Memory with your Date of Birth as its content (8 digits)
  NOTE: the example below (EDB71248) is not a valid Date of Birth.
- Connect it to the 7 segment display (see preparation above).
- Connect A B C of the decoder to the 74HC161 binary counter outputs Q_A Q_B Q_C, so that your Date of Birth digits can be read on the display.
- Take a photo of your working circuit.
- Demonstrate this circuit to a Lab Assistant
  OR make a movie (email a link to the movie to bellman@kth.se) (mailto:bellman@kth.se) .



*Electronic dice (suggested exercise)

** = extra exercise if you are finished with everything else*

- Design a 3 bit counter that cycles through the states “1”, “2”, “3”, “4”, “5”, and “6”.

  (or modify your 74HC161 + 74HC283 to get this sequence)
- Connect the counter with a free running oscillator (Arduino or one from Module 3).
- Ground pin 1 on the CD4543B to latch a number as the dice result.

*Full adder 74HC283 (suggested exercises)

** = extra exercise if you are finished with everything else*

- Build an Adder/Subtracter by adding XOR gates.
- Build a 2x2 bits multiplier using the full adder and 4 AND gates, connect the output to LEDs and use wires and switches as inputs.

*Shift register counters with 74HC74 and 74HC109 (suggested exercise)

** = extra exercise if you are finished with everything else*

- Connect 2 DFFs, 2 JKFFs (connected as DFFs with J and ~K connected together) and an XOR gate to test three different counters:

  Input = “1” Ring counter, “0” Moebius counter, “Q_0” PRBS (Pseudo Random Binary Sequence) (Google it)