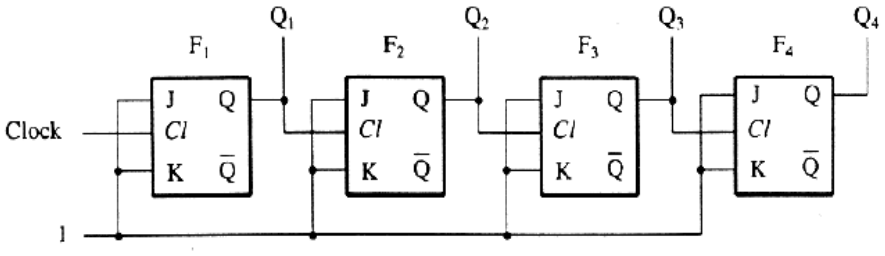
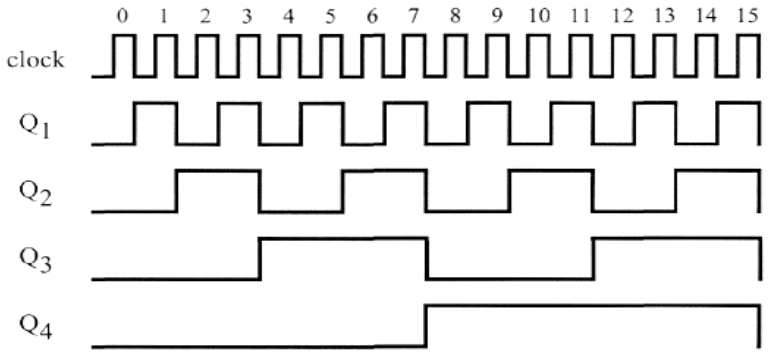
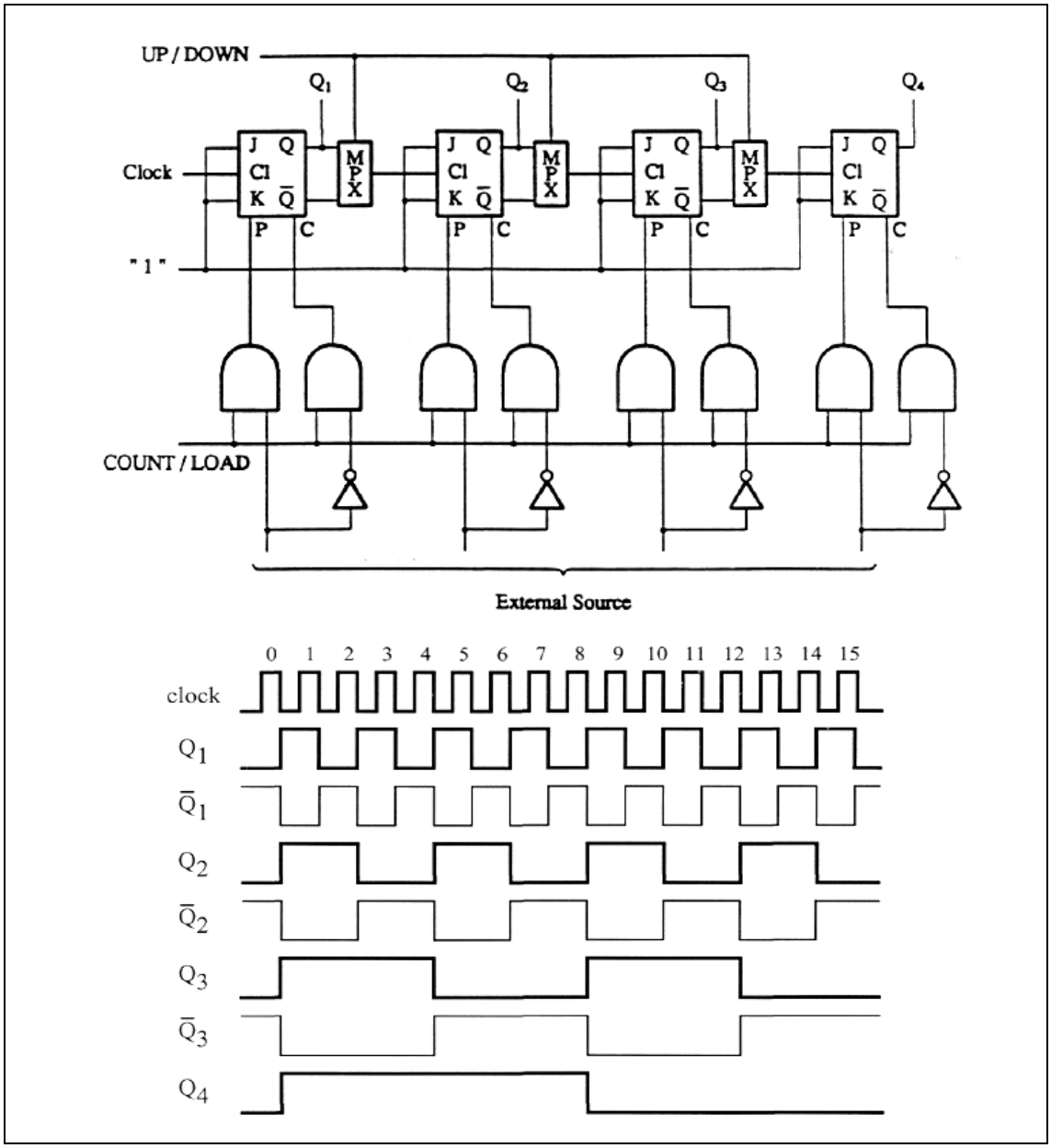
Typical Sequential Circuits

Example 1: Up-Down Counter



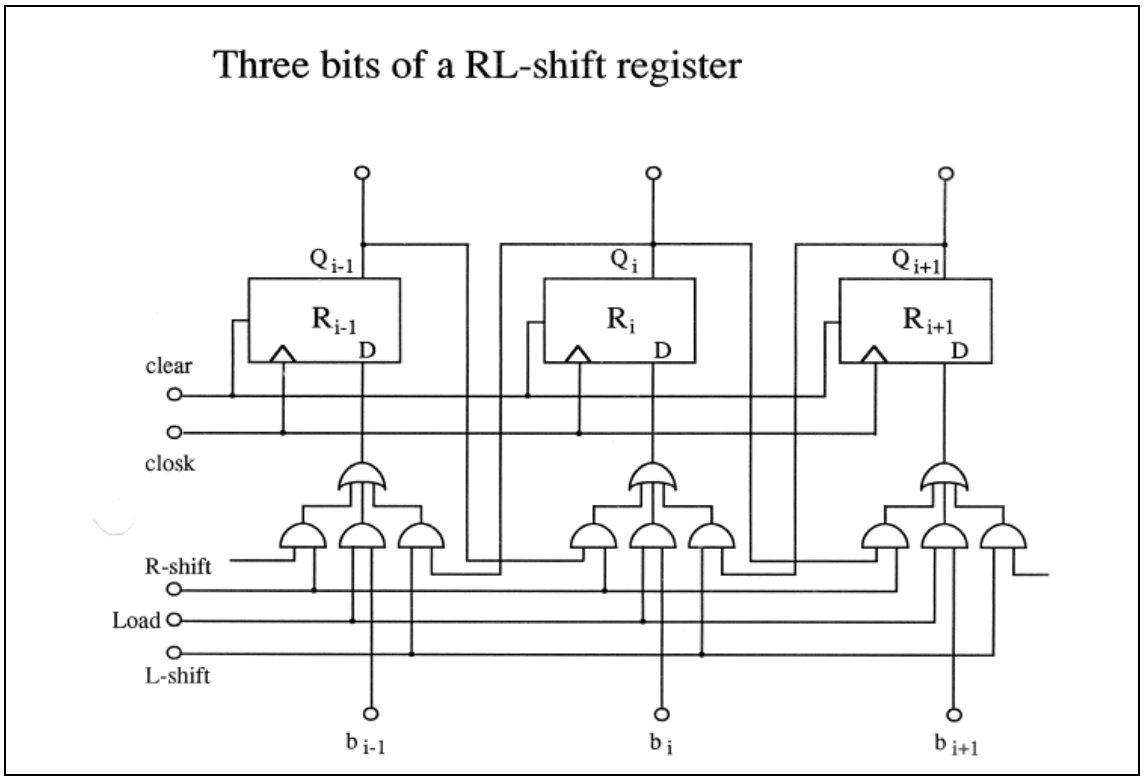
Up Counter



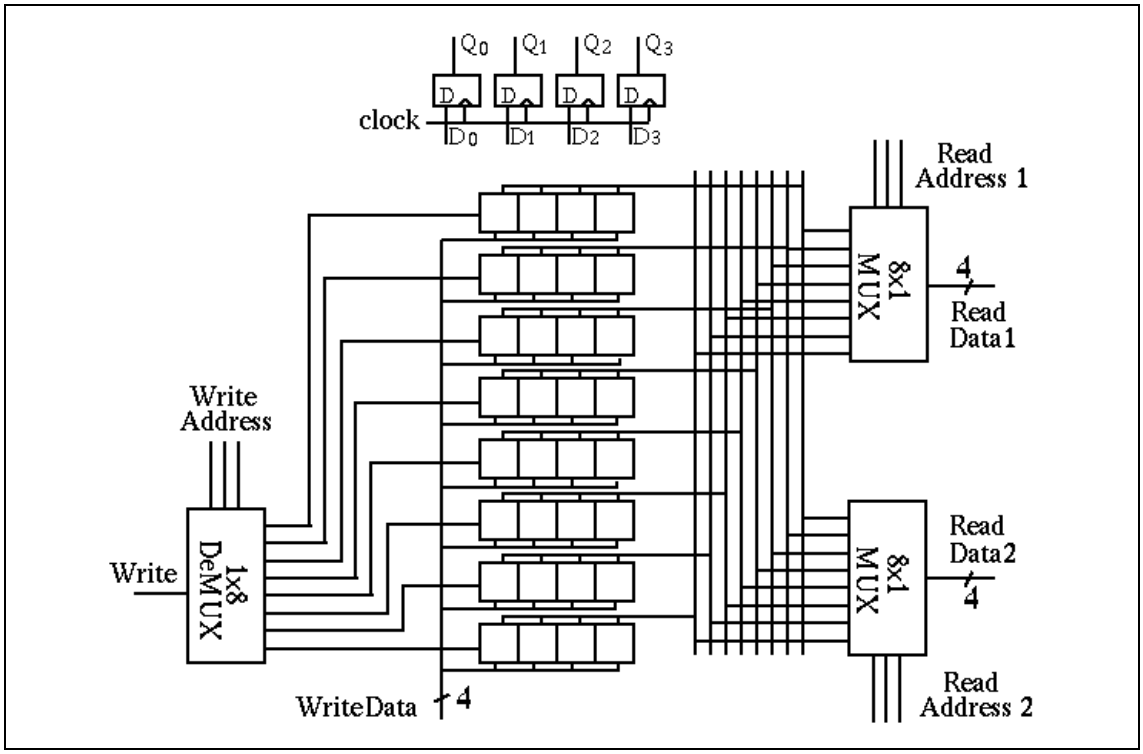


These counters are called ripple counters, as each flipflop in the counter has to wait for the triggering signal to be generated by the flipflop one bit lower. In other words, the triggering signal needs to propagate through all the bits, as a ripple propagating on water.

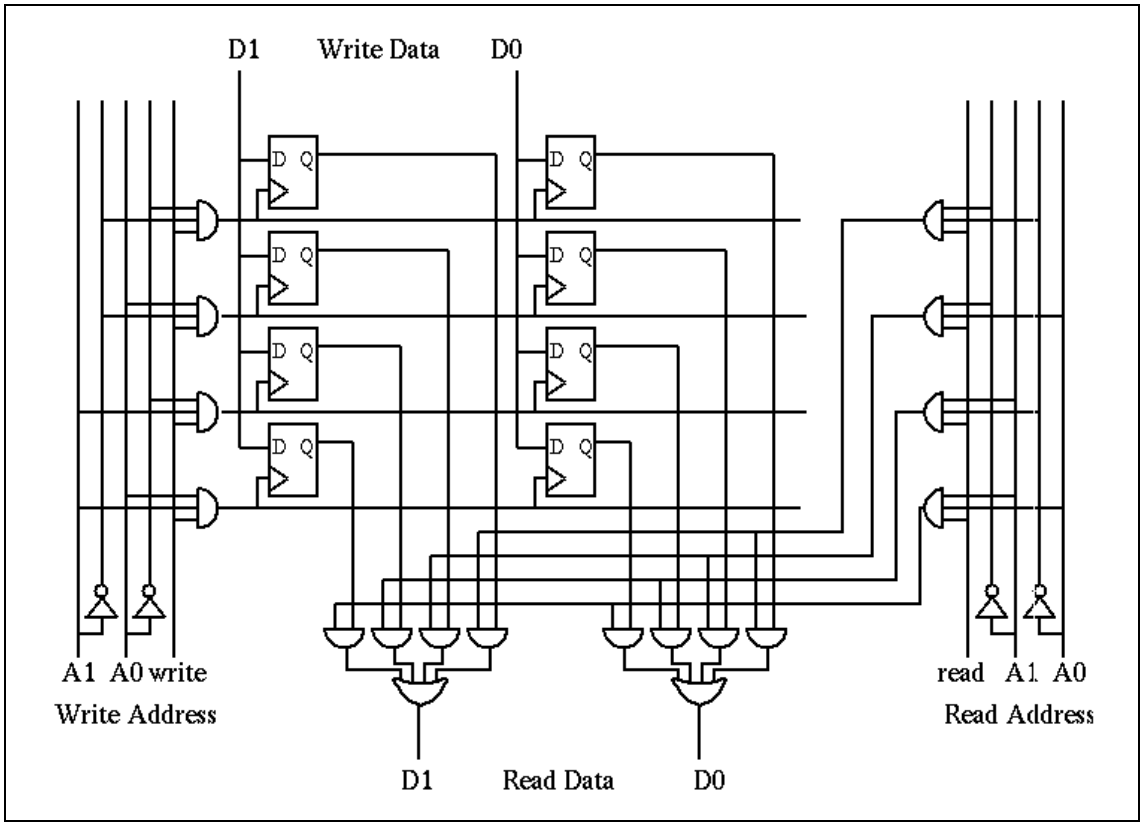
Example 2: Shift Register



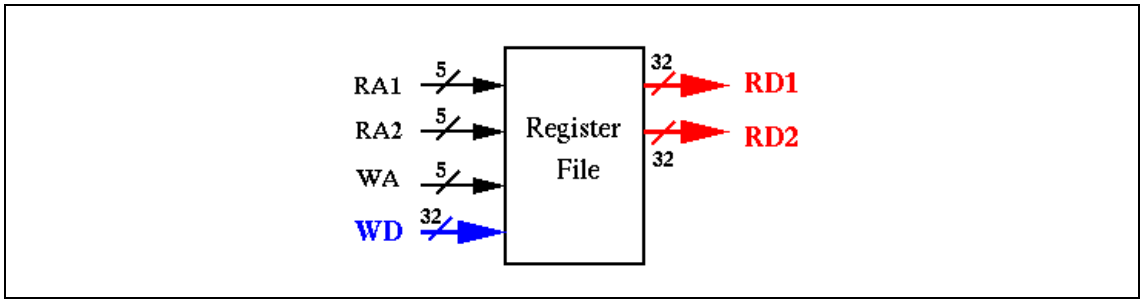
Below is an example of a register file (RF) of n = 8 registers each composed of m = 4 bits. Three operations, two *reads* and one *write*, can take place at the same time. The contents of two registers, selected by the two MUXs, each taking an address of $\log_2 n = 3$ bits, can be read simultaneously, while an m-bit word can be written into one of the n = 8 registers selected by the DeMUX, also taking $\log_2 n = 3$ bits of address. Note that all lines for data are a bus of 4 bits.



This is a more detailed diagram showing only two of the four bits of the registers:



A register file containing registers of 32 bits can be symbolically represented as shown below:



where RD1 and RD2 are the 32-bit words read from the two registers specified by the two 5-bit read addresses RA1 and RA2, and WD is a 32-bit word to be written into the register specified by the 5-bit write address WA.