Sequential Logic Systems

Digital Logic: The hardware from which computers, watches, cellphones, etc. are built

Moores Law: the observation that the number of transistors in a dense integrated circuit doubles about every two years. This is an observation was first made in 1965 and held for decades.

Standard chips: SSI, MSI, LSI, VLSI
Programmable Logic (PLD's, FPGAs, etc.)
Custom Chips, ASIC (Application Specific Integrated Circuits

Digital vs Analog: Digital has accuracy, repeatability, reliability (consider a watch)

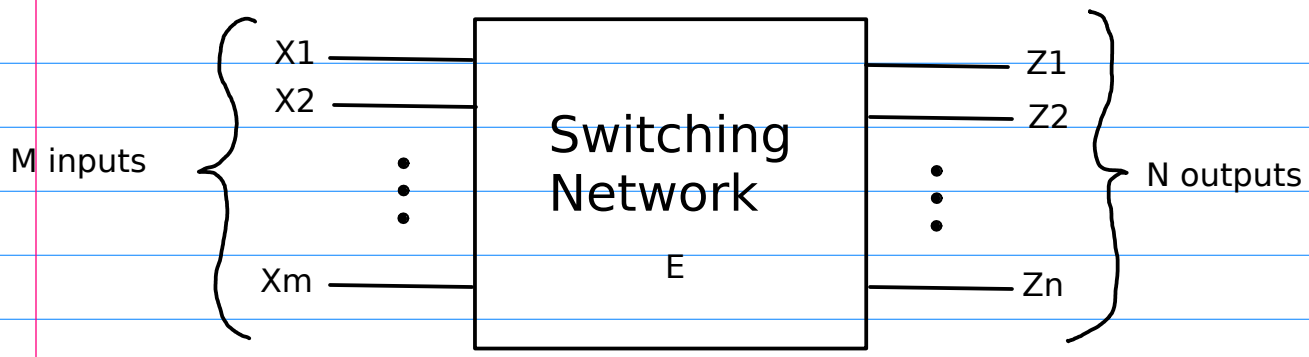
Digital design involves:

System design: how to break an overall system into subsystems

This course → Logic design: how to interconnect building blocks to perform a function
E.g., Gates + flip-flops --> Adder

Circuit Design: how to interconnect specific components
E.g., resitsors, transistors to make flip-flops

Switching Networks (about everything in this course is in this form):



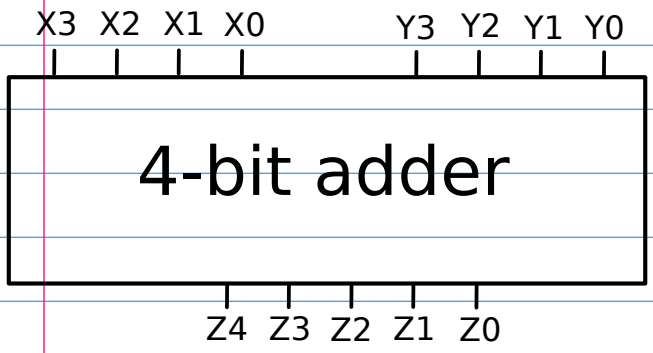
Can be:

Combinatorial - output is a function of the present inputs only (no memory)

Sequential - output is a function of the present and past inputs (requires "memory")

In General a sequential circuit is a combination of a combinational circuit + memory

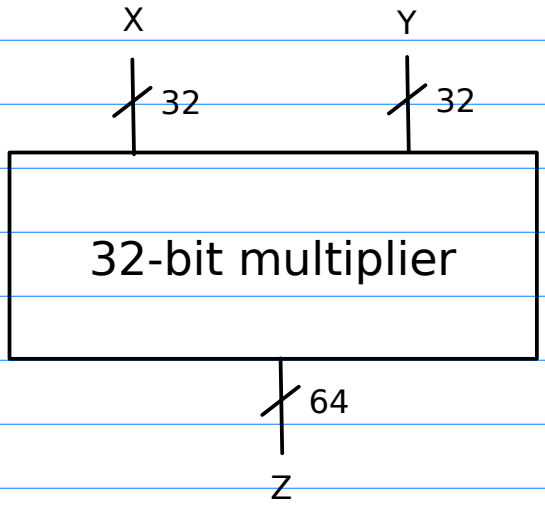
Example combinational circuits



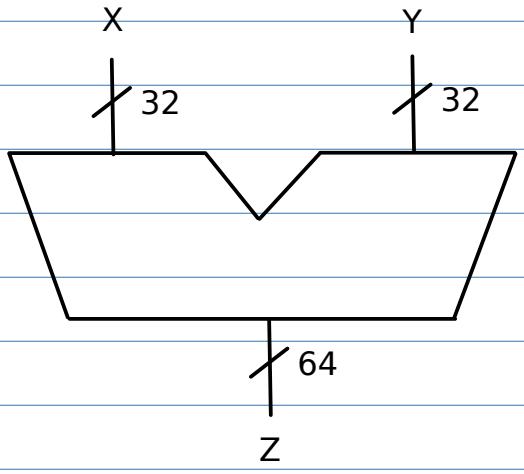
Truth Table for 3-bit version:

Inputs						Output			
X2	X1	X0	Y2	Y1	Y0	Z3	Z2	Z1	Z0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	1
0	0	0	0	1	0	0	0	1	0
0	0	0	0	1	1	0	0	1	1
⋮						⋮			
E.g., 3+6 → 0	1	1	1	1	0	1	0	0	1
⋮						⋮			
1	1	1	1	1	1	1	1	1	0

How about a 32- x 32-bit multiplier?

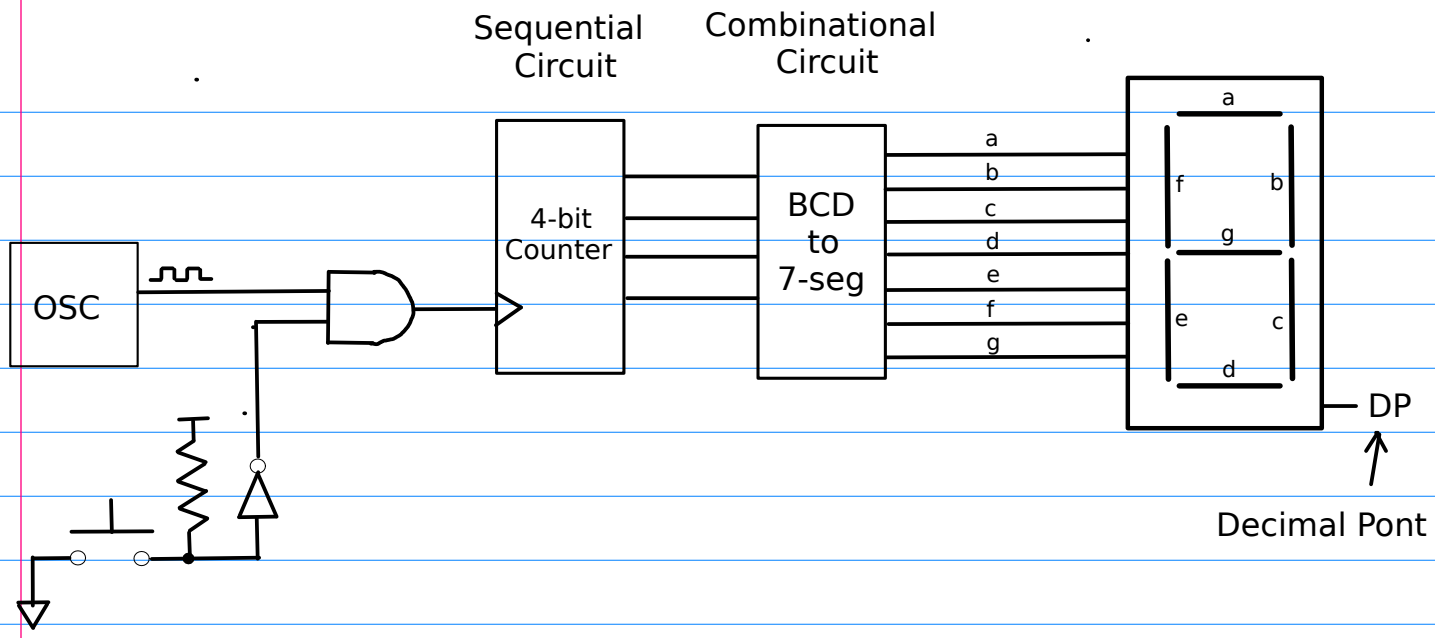


Same thing, just an alternate representation

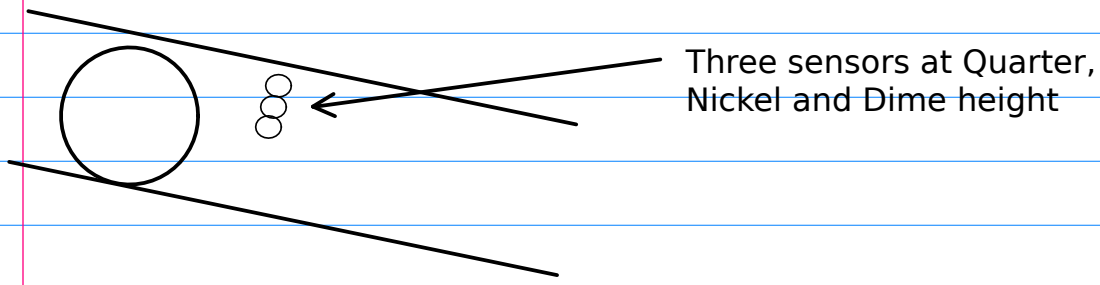


This operation could be "microprogrammed" -- making it sequential inside

It would operate similar to the way humans do multiplication of multiple digits through shifting and adding



Coins roll down slot



Sequential Circut generates total