

Overview:

- Sequential building blocks
 - Counters
 - Shift Registers
- Memory
 - Ram
 - Rom

HW Due ~~8~~ > LSN 29
GR

Error with Floating point 2's comp \rightarrow Decimal
101000.00100

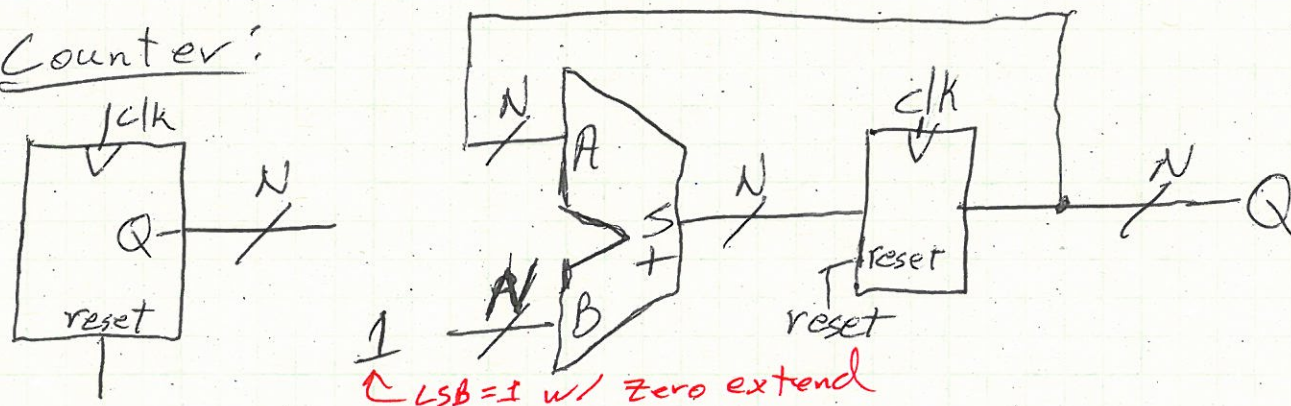
Flip
Bits \rightarrow

010111.01011
+ 1 \leftarrow add 1

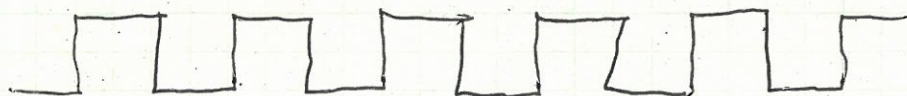
010111.11100 $\Rightarrow -23.875$
 .5, .25, .125

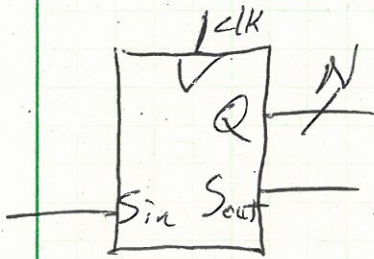
Difference b/w sequential & combinational
Logic circuits?

- Sequential has memory (ie. flipflops)

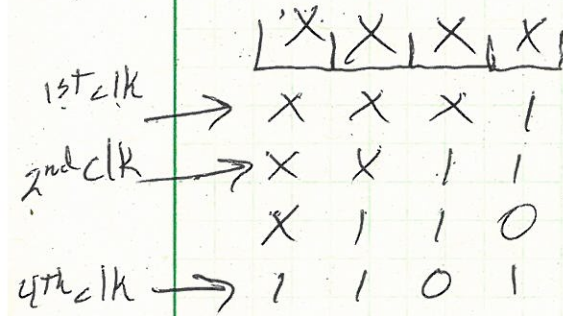
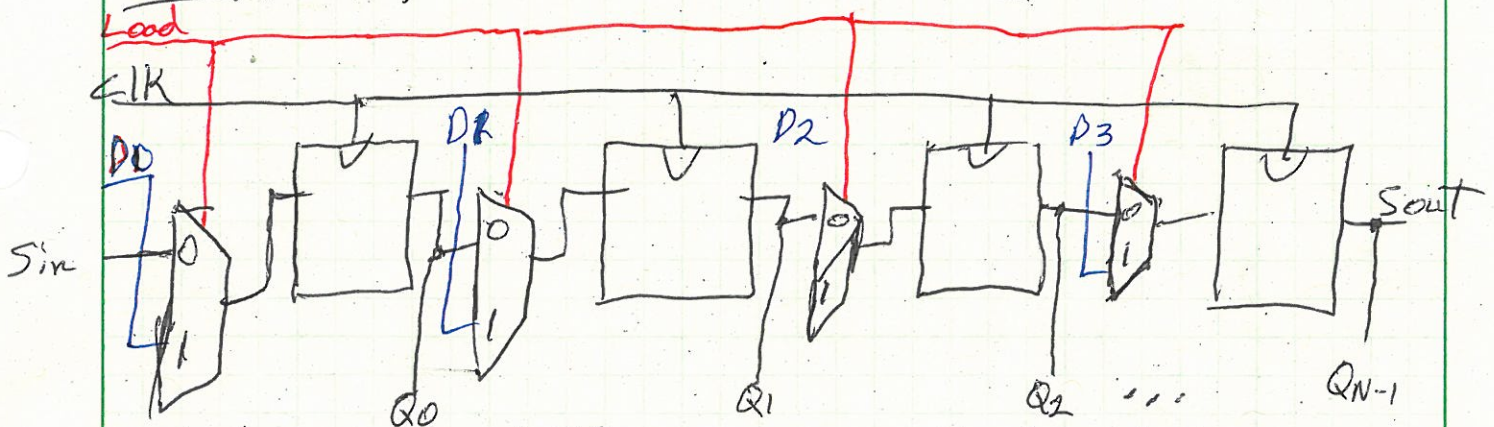
Counter:

Flip Flop - adds memory so we remember where
we are and where we have been



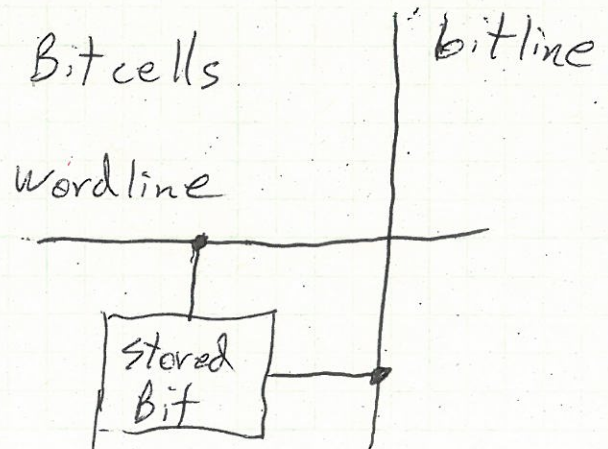
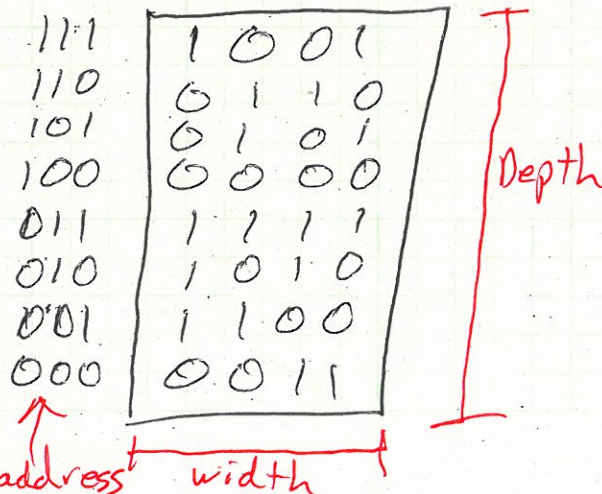
Shift Register:

- creates a serial-to-Parallel conversion
- shifts into LSB & outputs
- 4-Bits - given 4-bit system
- N-Bits

Shift Register w/ Parallel Load:

What is the difference btwn shifter & Shift Register?

Shifter is purely combinational Logic



Acts like a Decoder:

During a read ^{the} bitline is initially left Floating (Z) then the word line is turned ON allowing stored value to drive Bitline to 0 or 1

During a write the bitline is ~~dr~~ strongly driven to desired value. Then the word line is turned ON, connecting bitline to ~~st~~ the stored bit

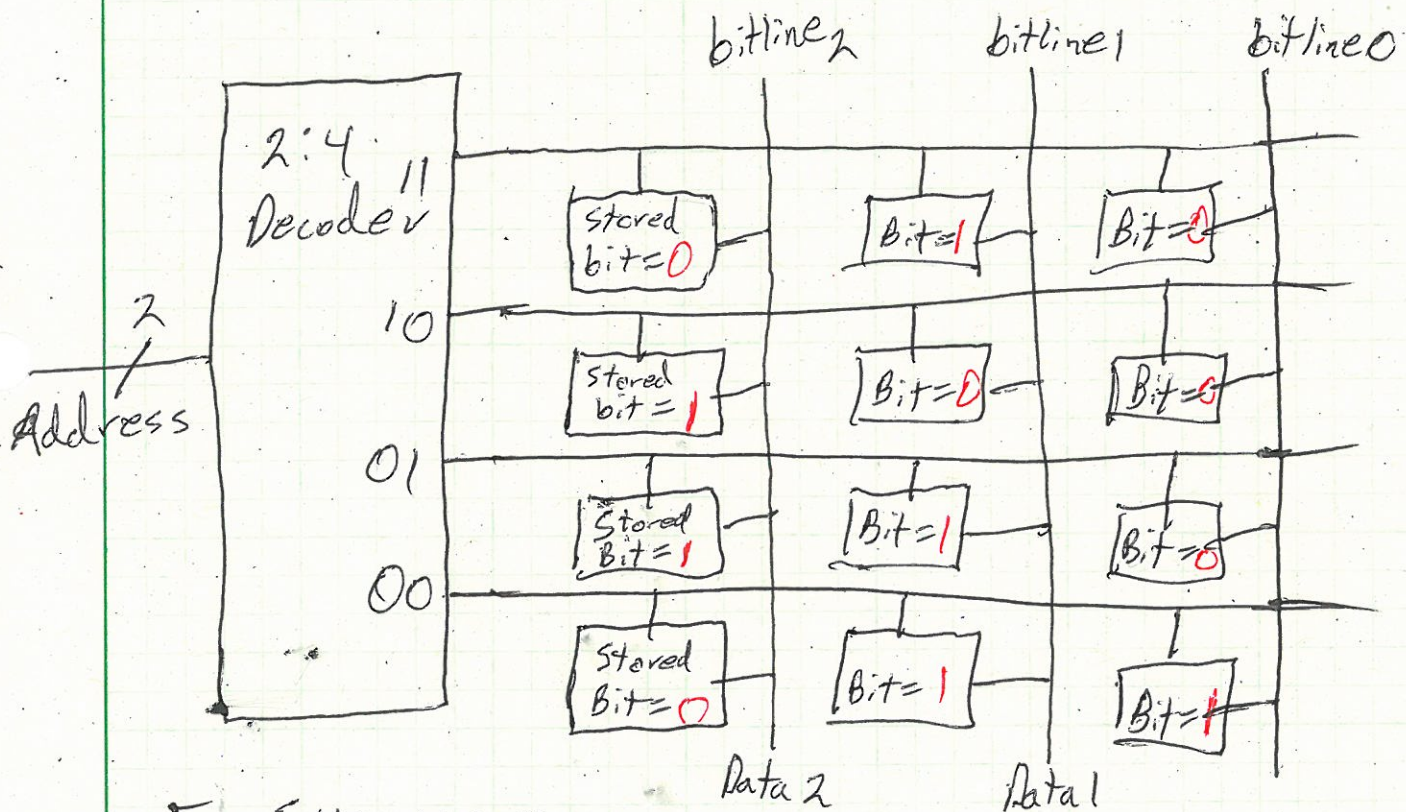


Fig 5.42 4x3 memory array

RAM:

- Loses its data when power is lost or turned off

↑ volatile

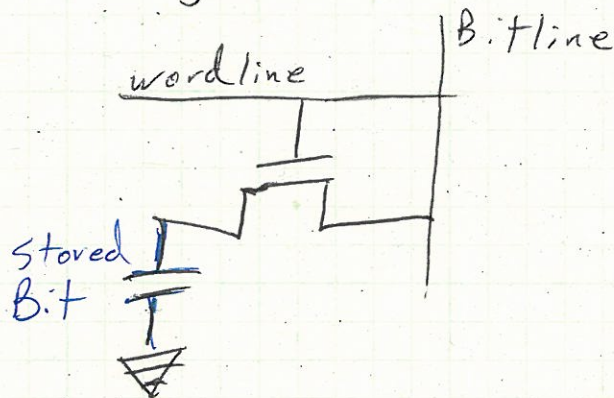
ROM:

- Non-volatile

2-Types of RAM:DRAM - Dynamic RAM

- bit stored as presence or absence of charge on capacitor
- Reading Destroys Bit
- needs refreshing every few ms

Fig 5.44 in Book

SRAM: - Static RAM

- bit stored in cross-coupled inverters
- inverters can restore value if noise interferes

	^{per bit cell} # transistors Latency	
F/F	~20	Fast
SRAM	6	Medium
DRAM	1	Slow

2-Types of DRAM: to increase speed limitation

SDRAM - Synchronous DRAM

DDR SDRAM - Double Data Rate (DDR)

Register File - Digital systems use a # of registers to store temporary variables. Group of registers called a register file, made of multiplexed SRAM array, more compact than an array of Flip-flops

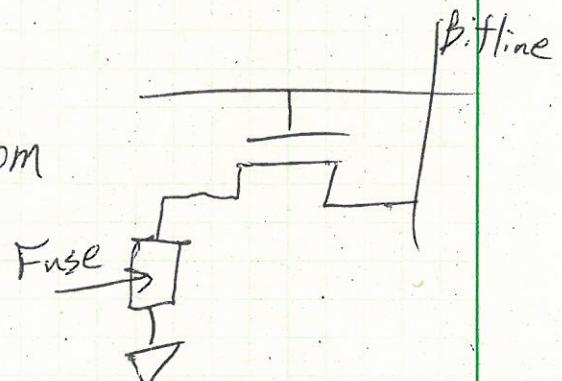
ROM:

- Bit stored as absence⁽¹⁾ or presence⁽⁰⁾ of transistor
- means we want to get it right before programming
- Combinational

PROM - programmable ROM

Fuse-PROM - fuse-programmable ROM

- Blow fuse to create a 1



EPROM - Erasable PROMs

- uses floating-gate transistors
- erased using UV Light

EEPROM - Electrically Erasable PROM
or double EPROMs

- No UV Light Necessary
- Includes circuitry for erasing & programming
- EEPROM bit cells are individually erasable

Flash Memory - erases larger blocks of bits

- ie cheaper