CPU - Central Processing Unit

* Clock the particular wire in CPU that turns on & off at a steady rate to keep everything in sync. In modern CPU's its measured in GHz i.e turns on & off several billion times / second.
  - this allows CPU to do complicated things quickly

Scott CPU - doesn't exist but shows how its architecture is

- CPU fits in motherboard which intun connects all the components
  - right side is RAM (Random Access Memory)

RAM

* list of address and each is a piece of data
  Data can be accessed orderly as well as randomly.

CPU sends address to RAM
Ram address is a series of 1 & 0's represents on & off
It doesn't do anything until the CPU also turns on enable / set
- when enable is on RAM sends data at address to CPU. via data bus.

this process happens over & over.
- sends & sets the set wire then RAM overwrites that data

Data in RAM

- Instructions - tells CPU to do things.
- Numbers - to process.
- Address - output as number send to monitor etc.
- Letters stored as character codes.

Instruction Set of CPU

LOAD - load a number from RAM to CPU
ADD - 2 no's together
STORE - from CPU to RAM
COMPARE - one & another
JumpIF - condition check to another RAM address
JUMP - move to another address
OUT - put device such as monitor
IN - input from device.

eg: Guessing Game

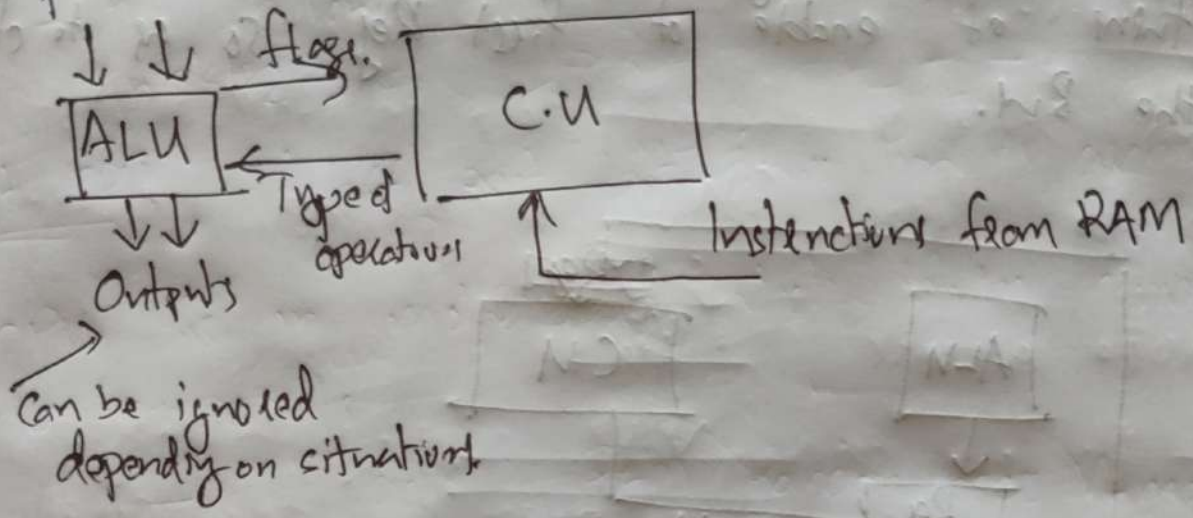
RAM

LOAD
G
IN
keyboard
COMPARE
JumpIF=
100110
OUT
MONITOR
"G"

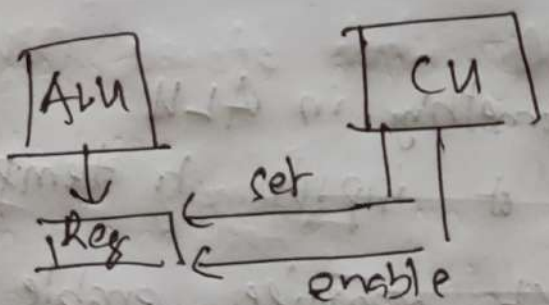
Guess again.

How processing an instruction

Control Unit - recive orders from RAM
under it one imp unit is
ALU - Arithmetic Logic Unit - perform arithmetic operation

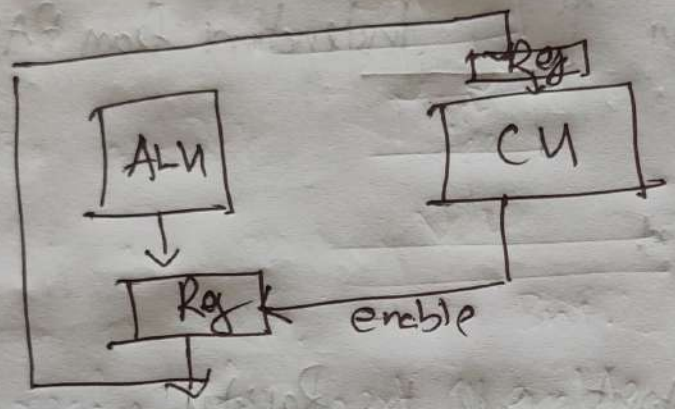


ALU → 8 wide output goes to Register.
Register - only job is to store a number temporarily
acts like RAM.
- it doesn't save anything until CPU turns on the set wire.



- CU turns the enable then only Reg. outputs what it just saved.

= Output of ALU Reg. connected to CPU Bus.
connects other components.
It have some other Registers with same enable & let
CU turns set of a particular Reg to save the
output from a Reg to it.
& turns of enable of first Reg so as to clear
the Bus.



advantage of Bus:
= easily moving components

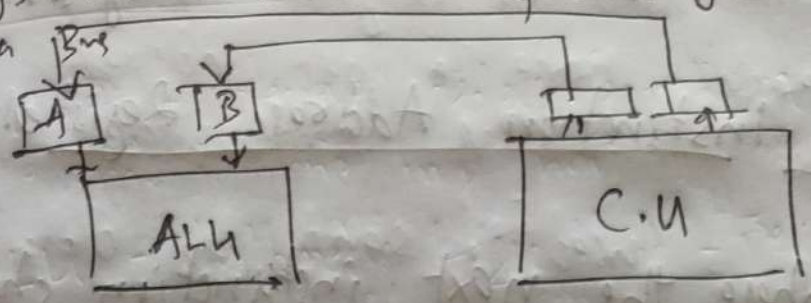
disadvantage:
= only one number at a time.

For this we have a temporary Register.
for input B

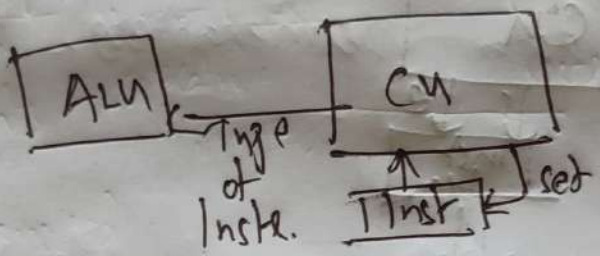
when CU proceds something in ALU
- it will move one of inputs to temp Reg
& Temp Register doesn't requiee enable since
it outputs only to ALU. & doesn't conflict with
any other reg.

other input comes directly from Bus

& stays on Bus until processing is complete.

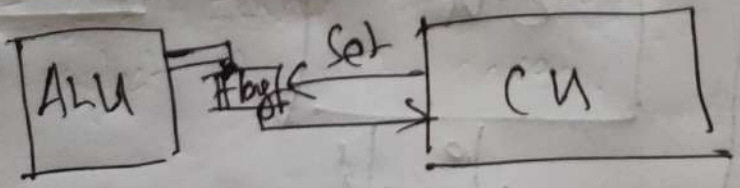


= To Tell ALU what to perform CU gets an instruction Register from RAM, No enable wire.



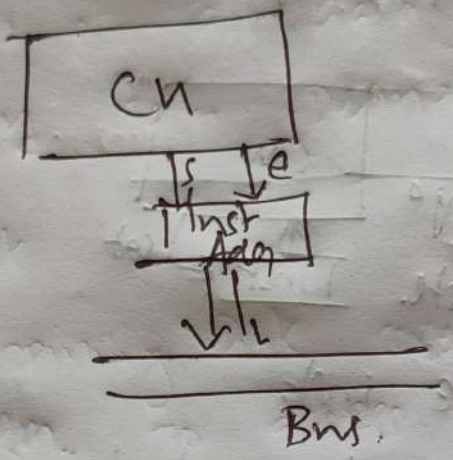
= If it is compare inst.
No need of what the output is so we have flags
In Scott we have 4 flags.
2 of them are:
→ A is larger. if both off B is larger.
→ Equal

* We need to save flags for next instruction to Flag Register with 4 inputs & 4 outputs
* Once set it is finished.



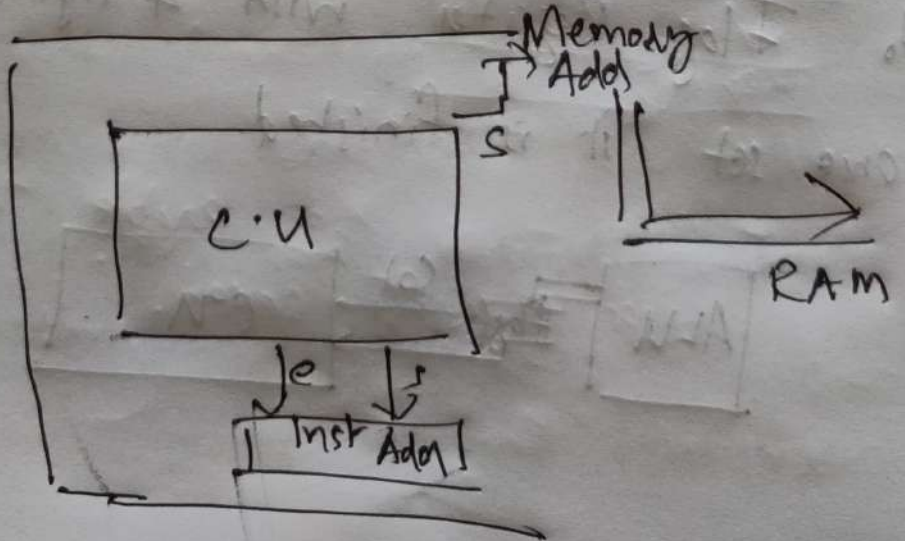
= We need to tell RAM we are ready for next instr.
we have Instruction Address Register

this tells where the next instruction should come from RAM.



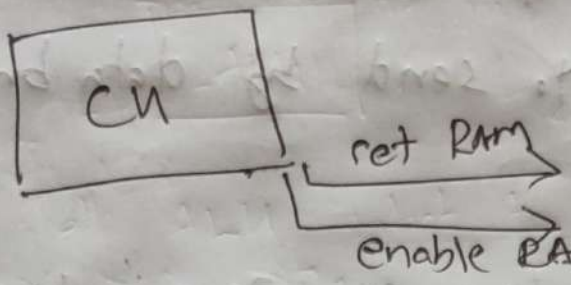
- when ready for next CU enable it. and address flows through the bus but doesn't yet to RAM directly.
we have Memory Address Register

Job is to tell RAM which address CPU wants next.



* when Memory Address is Set it automatically sends to RAM as there is no enable for MAR

*

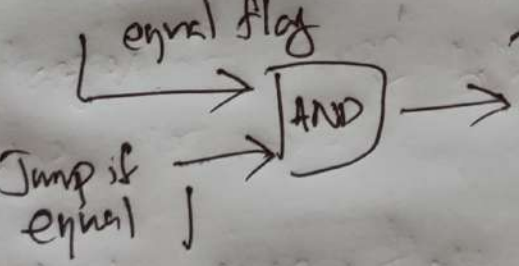


- CU then enable the enable RAM wire RAM then sends the data at that address which then goes back to Instruction Register.

= saved it there.

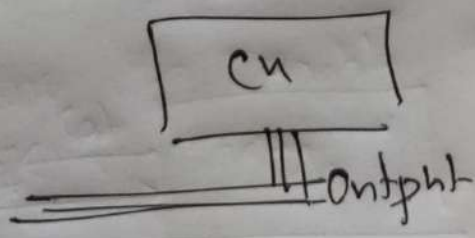
If Jump IP equal inst.

= It working by running one of its wire & Flag equal wire through an AND Gate if both are ON wires output is also ON =



= Now outputs to Monitor.

* Scott process this in 6 clock ticks. for each instruct



- ports on left is used to plug in input/output devices & each have a port address through which the CPU communicates with them. Port address is used to send by data bus.

- Hard Drive

when power is off all data in RAM is lost so for storing data permenantely. we use HDD

Inside a HDisk

- Its a spinning Disk covered with magnetic and an ARM. to access the data stored.

- But its not as fast as RAM so, we need to load data to RAM inorder to process it.