# LECTURE 20

# DIGITAL LOGIC FAMILIES

# ASM Design

- Data processing:
  - what sorts of manipulations of the input and output data are requested? How many/what sorts of things need to be stored?
  - How to design
    - Ad hoc/creative/by insight
    - List requested operations/manipulations
    - Include initialization controls
    - Include status lines

# ASM Design

- Control logic
  - All of the commands to the data proc. logic need to be controlled, and the status lines need to be monitored and acted upon.
  - ASM charts are like state diagrams, but without specific drawbacks.
    - Don’t list all inputs for each transition – don’t care inputs
    - Don’t list all outputs for each state – not changed outputs

# ASM Design

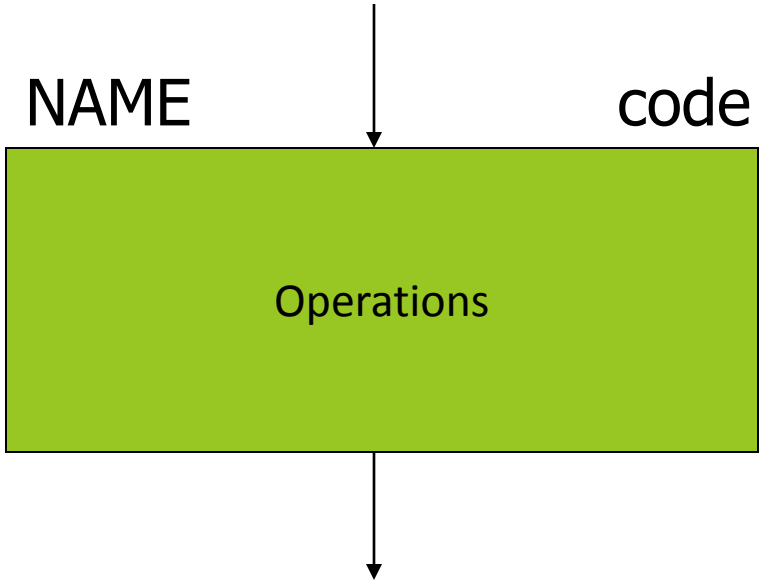
- How to design - ASM chart/state diagram (for small problems)
  - State assignment
  - State table
  - Kmap-gates/FF/Reg Mux Dec/EPROM, or, creatively, a combination of them

# ASM Design

- ASM charts are like flowcharts, with a few crucial differences. Be careful, especially with timing.
  - State Box
  - Decision Box
  - Combinational Box

# ASM Design

- State Box – one box per system state



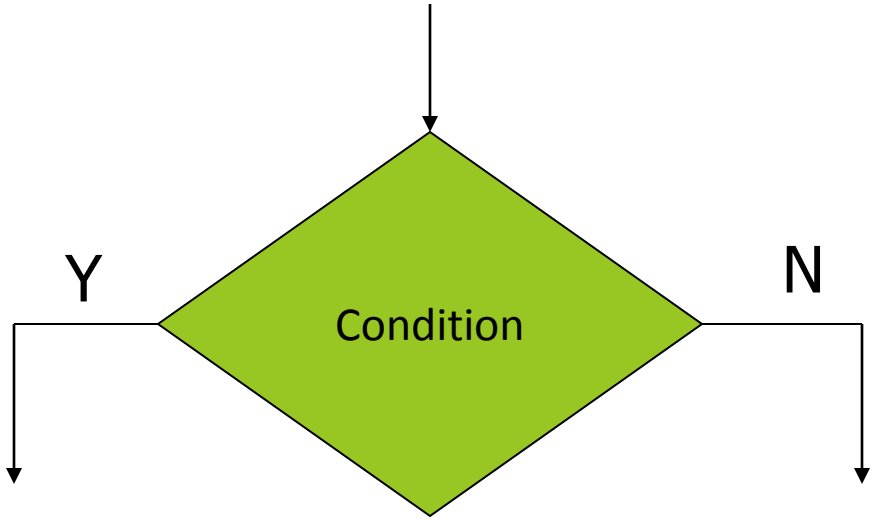

i.e. optioinal binary state code

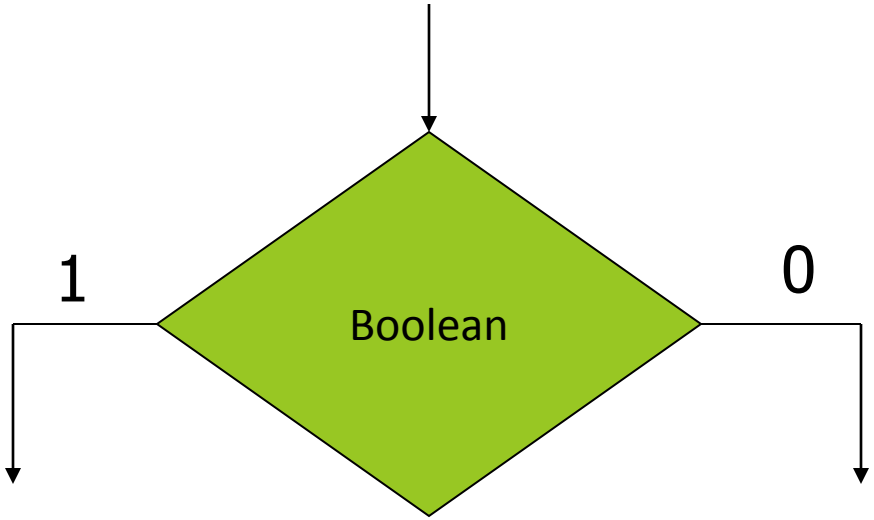
# ASM Design

- Operation notation:
  - Sum <- 0 or Carry <- 0 or LOAD A
  - Combinational variable: S=0, T=S+V
- Idea: keep operations abstract & high level. Don't work in detailed language of processing logic (i.e. write Sum <- 0, not $CLR_{Sum\ Reg}$=1)
- Operations will take place at the end of the clock period

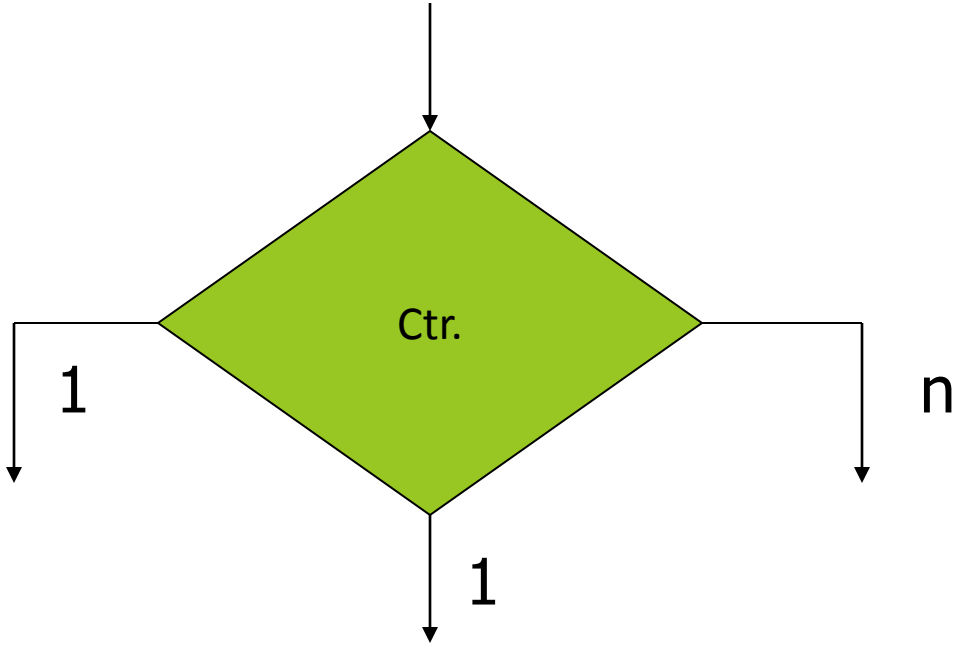
- Decision Box - Basic condition, i.e. logic flow control. Only the decision boxes depend on inputs.





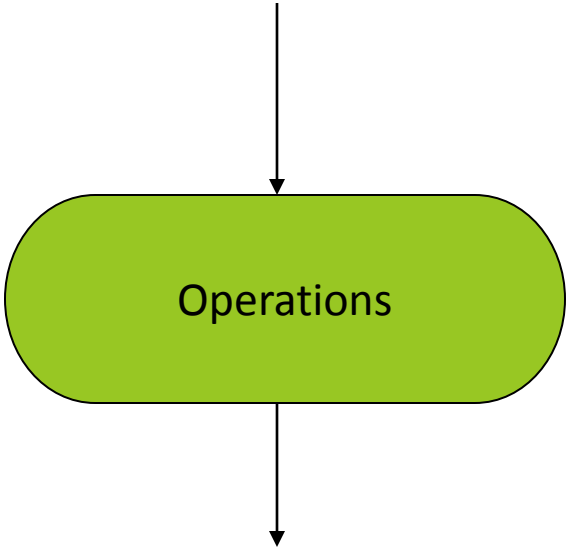
ASM Desig



# ASM Design

- Keep conditions as general as possible.
- Prefer: Carry high? Over $Q_{FF\#5}$=1?

- Conditional Box - An action/operation to be undertaken conditioned on some earlier decision box.




ASM Desig

# ASM Desig

- Conditional boxes do not appear in normal flowcharts. The essential difference is timing:
  - Flowcharts are sequential
  - ASM charts are not. All of the operations associated with a given state take place simultaneously.