# Algorithmic State Machines
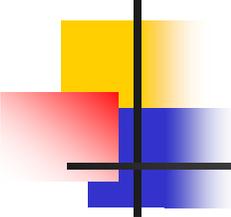
ASM Design

- 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
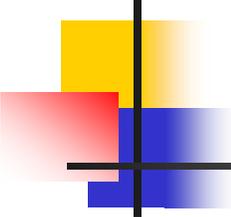
ASM Design

- 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
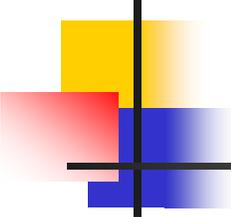
ASM Design

- 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
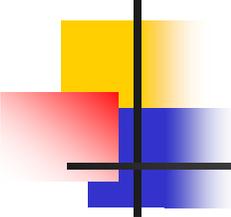
ASM Design

- ASM charts are like flowcharts, with a few crucial differences. Be careful, especially with timing.
 - State Box
  - Decision Box
  - Combinational Box
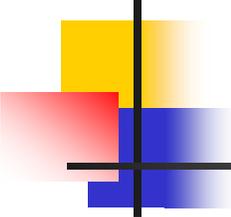
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- State Box – one box per system state

NAME   code   i.e. optioinal
                                     binary state
                                     code
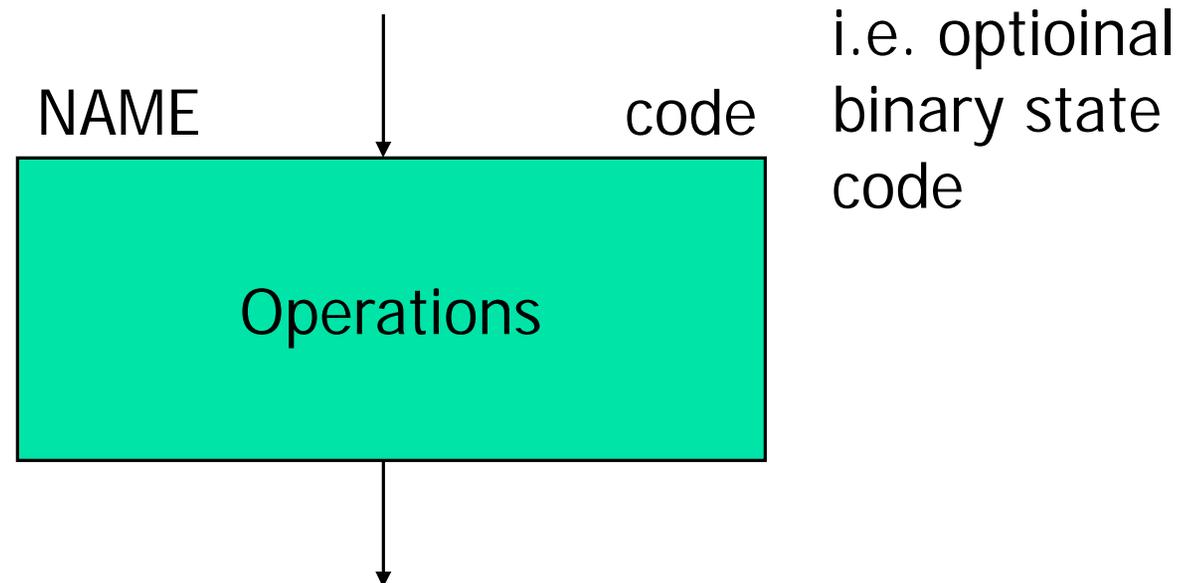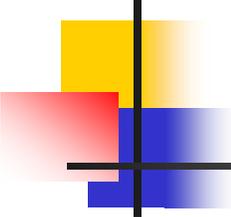
Operations

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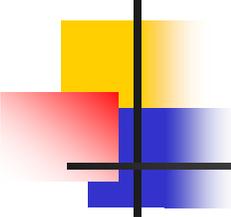
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- Decision Box - Basic condition, i.e. logic flow control. Only the decision boxes depend on inputs.

Y Condition N   1 Boolean 0
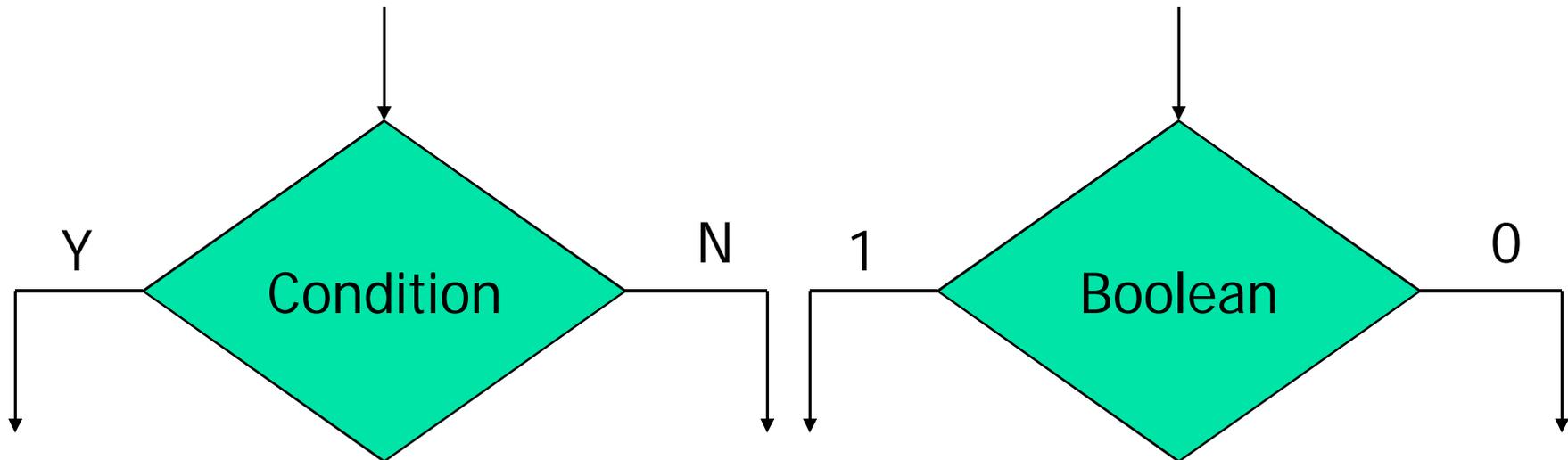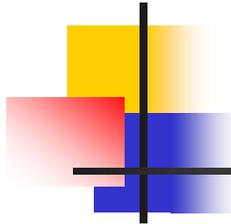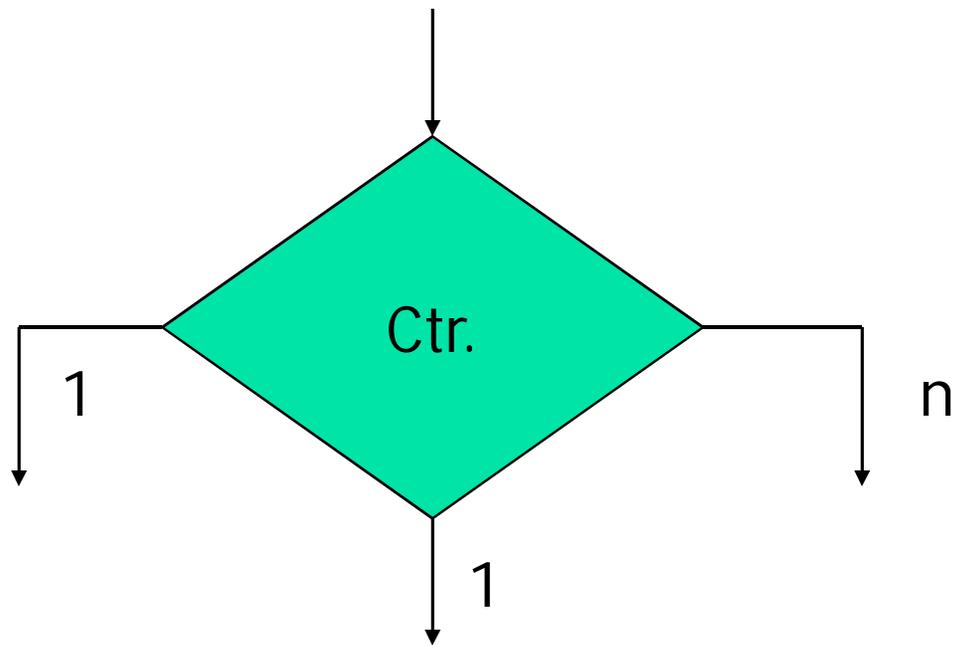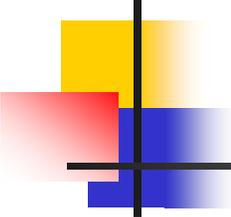
ASM Design

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- Keep conditions as general as possible.
- Prefer: Carry high? Over $Q_{FF\#5}=1$?
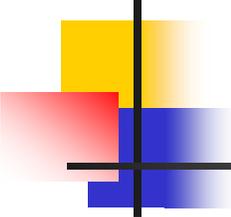
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- Conditional Box - An action/operation to be undertaken conditioned on some earlier decision box.
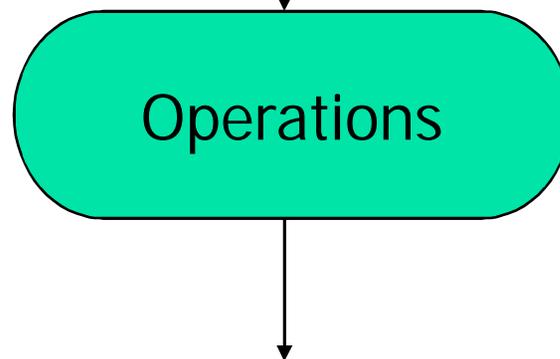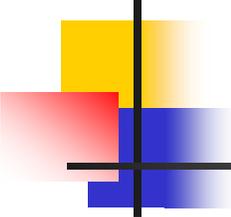
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- Conditional boxes do not appear in normal flowcharts. The essential difference is timing:
    - Flowcharts are sequential
    - ASM charts are not. All of the operations associated with a given state take place simultaneously.
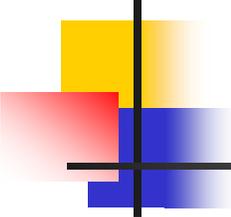
Assignment

- Q1 Draw an ASM Chart to generate the following sequence:
- 1,3,5,7,1.....