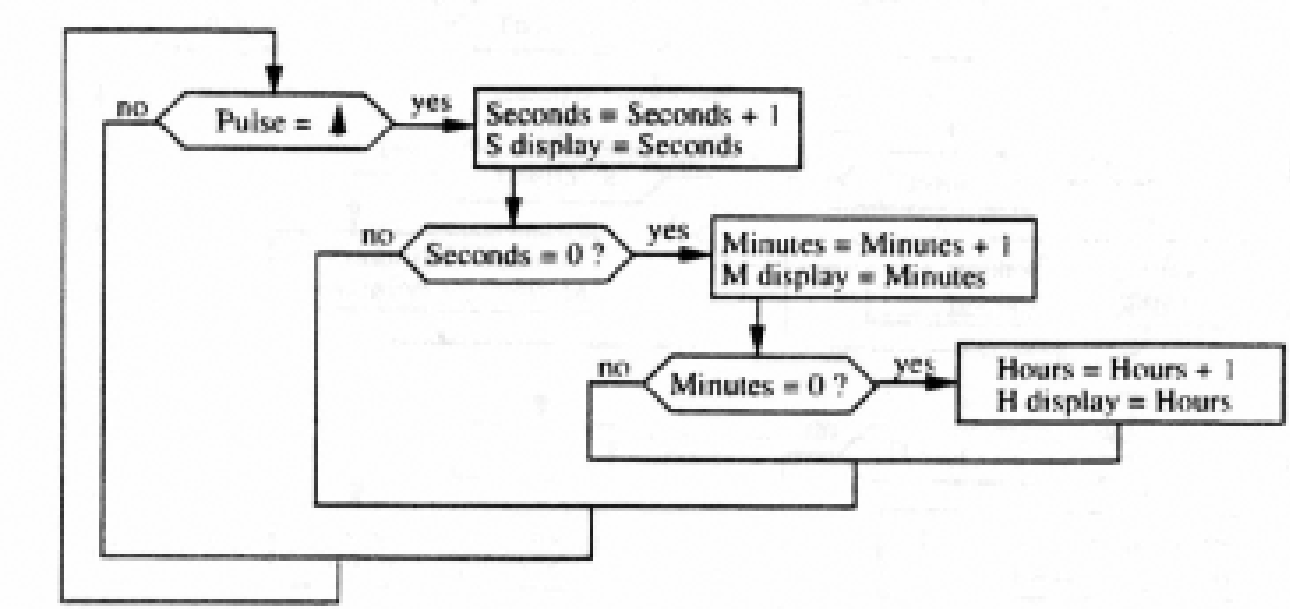
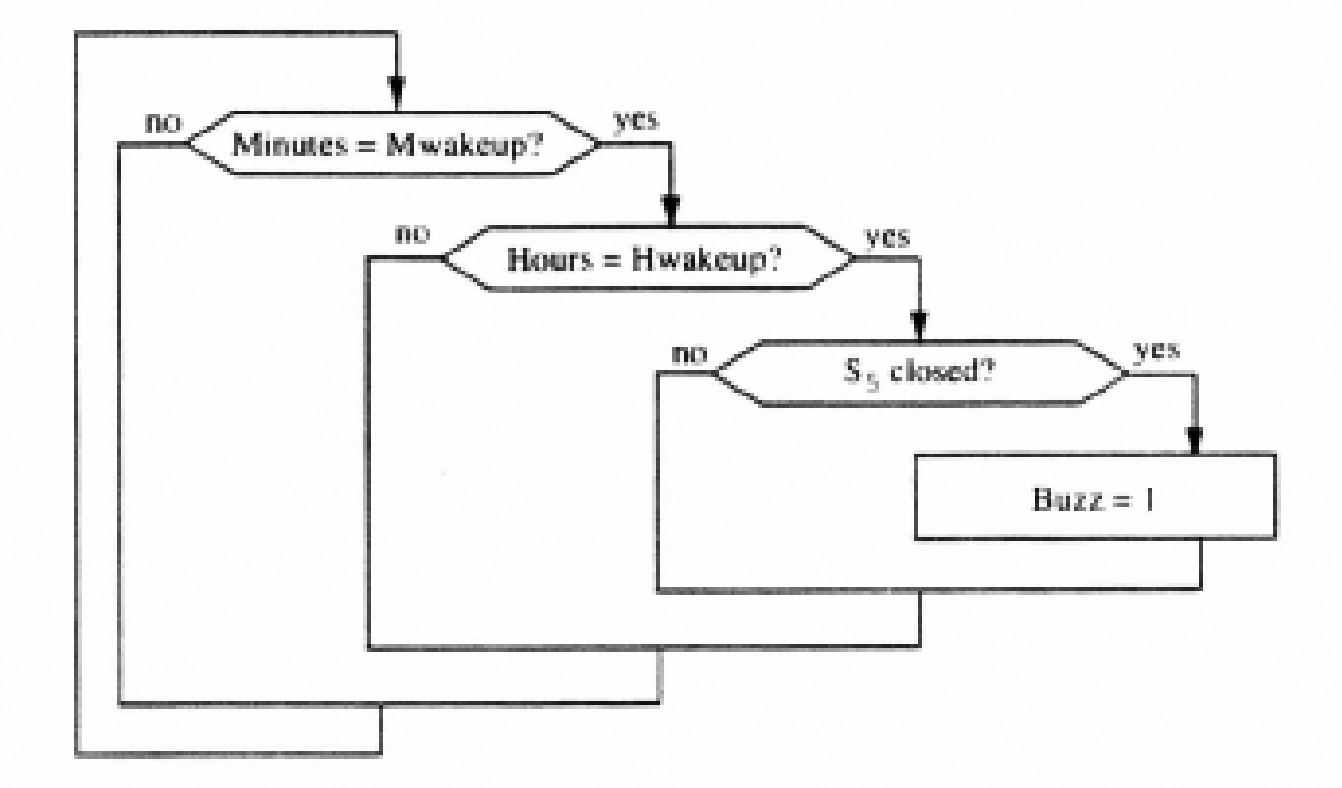
# Summer2018 CSE 140L
# Lab 1 Assignment – UCSD Alarm Clock

August 2018

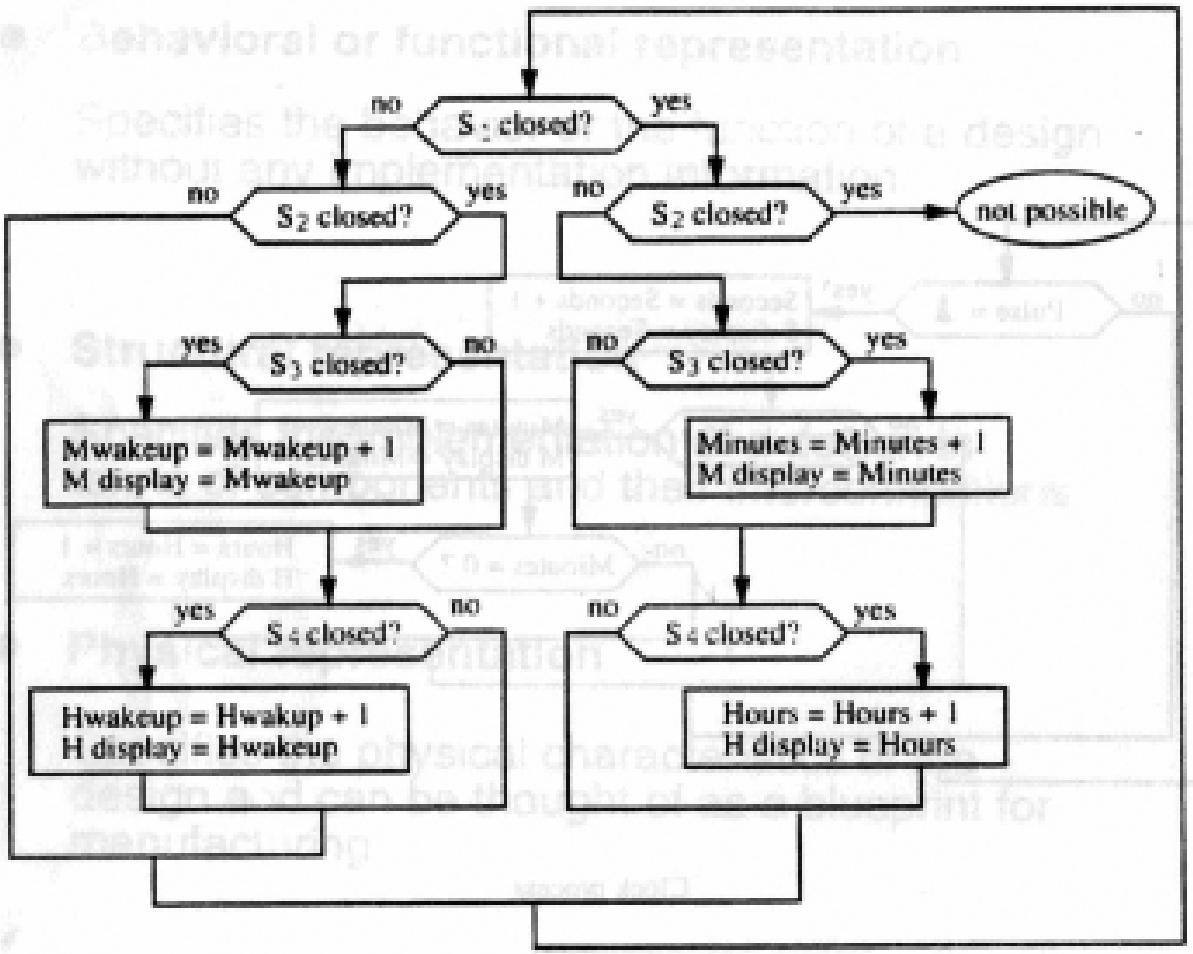
# Clock Behavioral Diagram



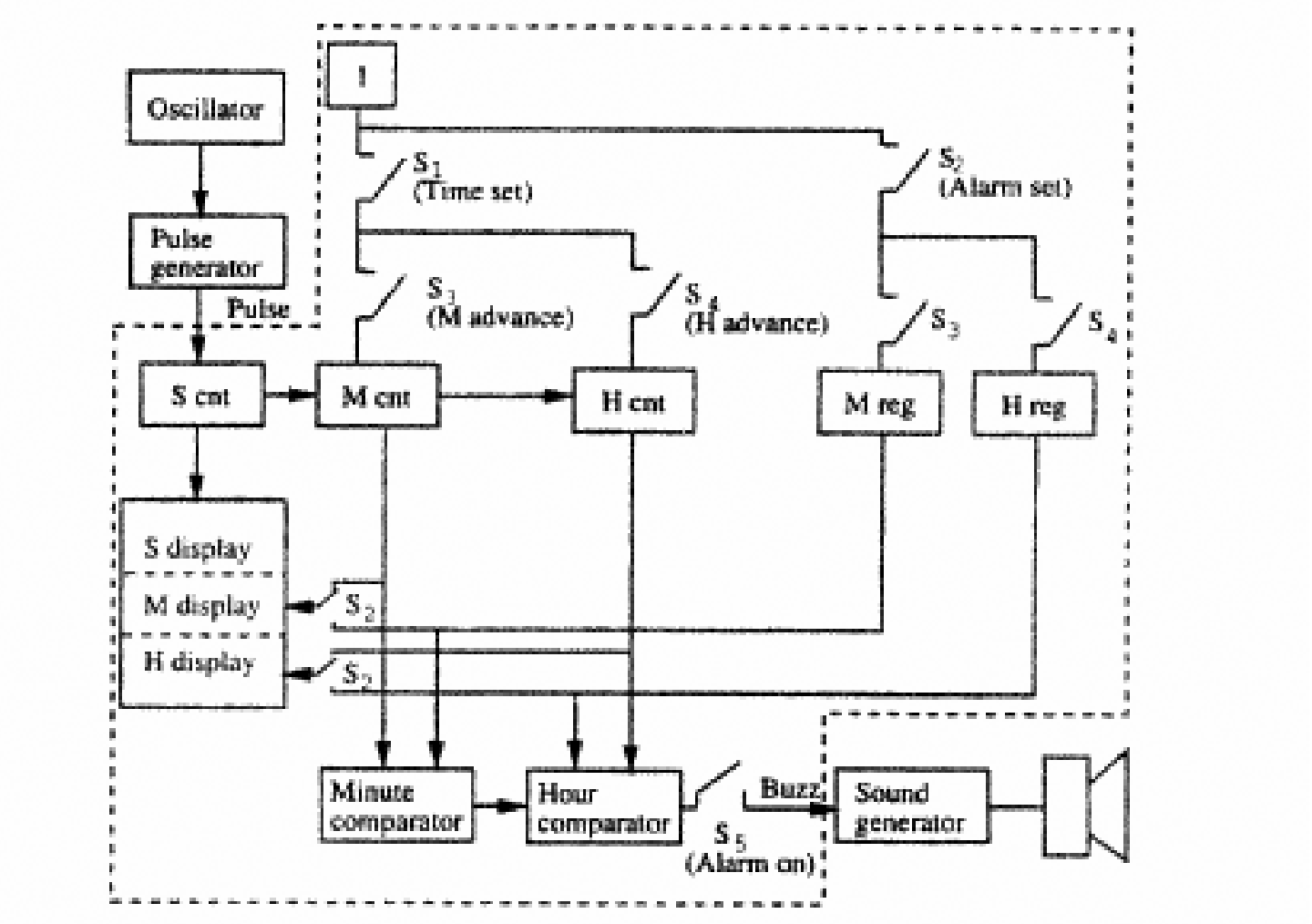
# Alarm Behavioral Diagram



# Combined Behavioral Diagram



# Structural Diagram



# Behavioral Description

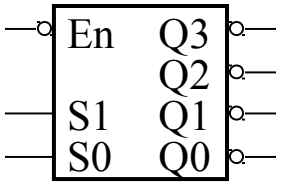
- **Part 1: Basic alarm clock**
  - User can adjust the clock time and the alarm time.
  - A single set of LCDs that display:
    - The alarm time when the user is setting the alarm;
    - The current time in all other cases.
  - User can turn the alarm on or off.
  - If the alarm is on, the buzzer goes high when
    - clock hour = alarm hour, and
    - clock minutes = alarm minutes.

# Behavioral Description

- **Part 1: Basic alarm clock**
- **Part 2: Days and Months**
  - The alarm clock keeps track of the day of week, day of month, and month of year information, and displays it on 7-seg Disp I/O
  - Requires 6 new counters
    - DayOfWeek, DayOfMonth, MonthOfYear for current time
    - DayOfWeek, DayOfMonth, MonthOfYear for alarm time
  - Should be displayed in the same manner as in Part 1, where:
    - The alarm date is displayed when setting the alarm
    - The current date is displayed otherwise

# Components Provided for Part 1

- **ClockDev:**
  - Seconds are incremented at each CLK cycle as in a regular clock. When its *Set* input is set, clock time can be adjusted by incrementing hours and minutes using *SM (Set Minute)* and *SH (Set Hour)* inputs.
- **AlarmDev:**
  - Very similar to **ClockDev** except that this block has neither a CLK input nor output for seconds.
- **LCD Interface:**
  - Takes a 6-bit input number (0 to 59) and displays it on 7-segment displays as two decimal digits.
- **6Comp:**
  - 6-bit comparator that gives a '1' output if the two inputs are the same.
- **MUX-2x6:**
  - 6-bit 2-to-1 multiplexer that selects one of the two 6-bit inputs and directs it to its output.
- **Decoder-4 (SystemVerilog library component)**:
  - If En == 1, all output = 1;
  - If En == 0, For *i* = 0 to 3, Q*i* = 0 if S1S0 == *i*;



# Components to be Implemented for Part 2

- **DayOfWeek**
  - Represents day of week.
  - Should use provided Counter-4 for basis of implementation.
  - (Current Time) Should count from 1 to 7.
  - (Current Time) Can be incremented via SPDT Pushbutton (independently of **DayOfMonth**) or through rollover of hours (in parallel with **DayOfMonth**).
  - (Alarm Time) Should count from 0 to 7.
  - (Alarm Time) Can be independently incremented via SPDT Pushbutton.
  - (Alarm Time) If set to 0, then the value is ignored when evaluating logic for the BUZZER.

# Components to be Implemented for Part 2

- **DayOfMonth**
  - Represents day of month
  - Should use provided Counter-8 for basis of implementation
  - (Current Time) On months 1, 3, 5, 7, 8, 10, and 12, this should count from 1 to 31.
  - (Current Time) On months 4, 6, 9, and 11, this should count from 1 to 30.
  - (Current Time) On month 3, this should count from 1 to 28.
  - (Current Time) Can be incremented via SPDT Pushbutton (independently of **DayOfWeek**) or through a rollover of the hours (in parallel with **DayOfWeek**).
  - (Alarm Time) Should **always** count from 0 to 31
  - (Alarm Time) Can be independently incremented via SPDT Pushbutton
  - (Alarm Time) If set to 0, then the value is ignored when evaluating logic for the BUZZER

# Components to be Implemented for Part 2

- **MonthOfYear**
  - Represents month of the year
  - Should use provided Counter-4 for basis of implementation
  - (Current Time) Should count from 1 to 12
  - (Current Time) Can be incremented only through rollover of **DayOfMonth**
  - (Alarm Time) Should count from 0 to 12
  - (Alarm Time) Can be independently incremented via SPDT Pushbutton
  - (Alarm Time) If set to 0, then the value is ignored when evaluating logic for the BUZZER

# Component Increment Rules for Part 2

- **Current Time**
  - **DayOfWeek** and **DayOfMonth** are increment independently when setting the current time.
  - **DayOfWeek** and **DayOfMonth** are incremented in parallel upon a rollover of the hours.
  - **MonthOfYear** cannot be set directly.
  - Ensure always correct date by appropriate rollover.
- **Alarm Time**
  - All counters can be set independently, even to an invalid date.

# Making Custom Components

**To make a custom component:**

1. Design a circuit that implements the component's functionality
2. Identify the component's inputs and outputs, attach ports to your circuit accordingly

   – You must name your ports: right click the port and click “name”
3. Open a new file (File → New → Device Symbol)
4. Import pin list from existing design
   1. Options → Subcircuit and Part Type → Create subcircuit symbol and select open circuit to attach to it
5. Draw your circuit
6. Place the pins on the circuit (from the left)

   – Click the appropriate buttons for the desired direction of pins
7. Save the component in a library of your choice