

*Homework 4 is really just homework 2b, but calling it that would ruin the numbering scheme. Solution templates can be found in /home/classes/ee4702/files/v and will be linked to the web page.*

*Changes made to this assignment 13 March 2000, 10:02:54 CST. Changes are shown in a slanted (not italic) font.*

**Problem 1:** Suppose the marks are glued on the disks used in the problems above and that sometimes they fall off. (Or maybe they're stolen, or painted over.) Design a behavioral Verilog module that can compute the correct rotation rate when as few as  $\lceil \frac{m+1}{2} \rceil$  marks are still present, where  $m$  is the original number of marks. The angle subtended by the marks (their width, sort of) is not known.

Use the same design rules as for `tach2`. You may base the solution to this problem on your solution to homework 3 (perhaps corrected) or the posted solution to homework 3.

*The module does **not** have to measure zero correctly, when the rotation rate is below the minimum measurable speed any output is acceptable.*

```
module tach3(rpx,pd,clk);
  input pd, clk;
  output rpx;
  wire pd, clk;
  reg [9:0] rpx;

  parameter freq = 500; // Clock frequency.
  parameter marks = 12; // Four pulses per revolution, when new.
  parameter perwhat = 60; // Measure in revolutions per 60 seconds.
  // Code here.

endmodule
```

**Problem 2:** Design a testbench for the code above. The testbench should test the ability of `tach3` to work with missing marks. The testbench can be based on the `tach2` testbench provided with homework 3.

*The testbench should be able to handle a disk with up to one hundred marks. Test at least these patterns: all marks present, one mark missing, the maximum number of marks missing and spread out as much as possible (so almost every other mark is missing), and the maximum number of marks missing where the missing marks are all adjacent (so there will be a big gap). Also, add a pattern of your own.*

*See the hint at <http://www.ee.lsu.edu/v/2000/hw04hint.html>.*