

**Due to Prof. Walker by 5pm on Wednesday 5 November 2003**  
*this project counts as 10% of your course grade*

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1. Do **Exercise 4.21 on page 182** of *Digital Systems Design and Prototyping, Second Edition*. Code the major part of the design in AHDL, though it is acceptable to represent the high-level design graphically and use some pre-designed components. Use the FLEX chip on the UP1 board, use the two pushbuttons as the brake and accelerator, use the decimal points on the 7-segment LEDs to indicate PARK (OFF, OFF) and three DRIVE gears (first = OFF ON, second = ON OFF, third = ON ON), and use the 7-segment LEDs to display the speed in 100s of RPMs.

For those not familiar with driving a car with a manual transmission, as a car accelerates in a particular gear the RPMs increase, but when the driver shifts to the next higher gear, the RPMs decrease in that new gear (for convenience in this design, assume they decrease to 1/2 their previous value). Similarly, when the driver decelerates or brakes, the RPMs drop, but when the driver shifts to the next lower gear, the RPMs increase in that new gear (for convenience here, assume they double).

Turn in:

- a) a document that describes your design and any design decisions that you made (20 points)
- b) a readable (not microscopic) printout of the schematic (10 points)
- c) a printout of the test inputs and simulation output that shows that the circuit works as expected, annotated to explain the operation of the circuit (20 points)
- d) a signature on the statement below by Prof. Walker, by the TA (Ping Xu), by one of Prof. Walker's research students (Kevin Schaffer, Meiduo Wu, or Hong Wang), or by two other students in the class (50 points):

I certify that \_\_\_\_\_ has successfully downloaded this design to a UP1 board and the design works correctly.

\_\_\_\_\_ Name \_\_\_\_\_ Date

\_\_\_\_\_ Name \_\_\_\_\_ Date