Name: _____

Homework Number 1

Due **Monday, March 24, 2014**

Answer the following questions to the best of your ability.

#1 A system is to be designed which will aid pilots in safely taking off from an airport. By definition, the pilot will take off into the wind and away from the sun if possible. However, if the wind is greater than 15 knots, the pilot must take off into the wind, independent of the direction of the sun. Temperature also influences this decision. The system that is to be built will take the appropriate inputs and generate a radio message to the pilot telling them how to take off. Additionally, this information will be relayed to the air traffic controller and logged into a database. Given this description, draw a basic system diagram for the software that is to be written.

#2 A system is to be built which is intended to count the number of cars going through an intersection. The cars will travel through the intersection without stopping at an average speed of 55 miles per hour. Based on this description, is this a hard, firm, or soft real time system and why?

#3 A system is being designed which will cut a roll of paper 8.5 inches wide into 11 inch lengths. The paper is rolling at 110 inches per second, and each cut is made by a single knife without the feed stopping.
   a.   Given this description, how often is a cut made to the paper?
   b.   If the papers must be $11 \pm .01$ inches, what is the minimum punctuality required for the cut? (Express this as the maximum deviation epsilon from the scheduled time.)

#4 You have been tasked with the design of a new system to visually place parts on an assembly line, moving moves at 20 m/s. The vision system operates following these steps
   •   Take picture with camera 1
   •   Analyze picture to locate arbitrarily-oriented part
   •   If part not detected
        o   Take second picture with camera 2
   •   If part not detected again (or part defective)
        o   Reject part – rolls off conveyor into bin
   •   else
        o   Pick up part, place on assembly
Determine the distances a and b to guarantee that the part will be in the view of the second camera.

Activity	Minimum Time	Average Time	Maximum Time
Detect part in range	2ms	5ms	10ms
Send signal to a camera	1ms	1.5ms	2ms
Take picture	5ms	10ms	25ms
Analysis of image	50ms	75ms	100ms