EECS 571 **Homework No. 1** **Fall'10**

Due: September 27, 2010

Please submit *computer-generated* answers confirming the format outlined in the first handout by the class time on 9/27/10.

1. (True or False) A computation task can be critical at one time but non-critical at another time within the same mission. Justify your answer with an example.

2. Specifying timing constraints is a difficult but important step for designing embedded real-time systems. I also said in class that such timing constraints come from mother nature, or are artificially imposed. Give an example of each. Also, how would you derive (i) inter-task message deadlines from task deadlines, (ii) memory or disk I/O access deadlines from task deadlines, and (iii) task deadlines from end-to-end application deadlines.

3. Construct a sporadic task along with an accompanying periodic task for an application laymen can understand.

4. A real-time control system that consists of a controlled plant and a controller is a typical cyber-physical system (CPS). What are C and P in a real-time control system, and how are they coupled with each other?

5. List 5 example CPSes with identification of C and P parts for each.

6. List three key approaches to the performance improvement for general-puprose (GP) computing systems. Why are GP systems unsuitable for real-time systems?

7. **Execution time analysis of concurrent tasks**

   - List (each with a clear explanation) difficulties associated with the analysis of concurrent dependent tasks execution time as compared to that of single-thread tasks, and state why such an analysis is important.
   - Give a detailed account of how the continuous-time Markov Chain model in Figure 22 of the paper by Peng and Shin can be derived.

8. Read and summarize (1) two papers in the area of task execution time estimation with cache and pipelining and (2) a paper related to CPS, following the format specified in the first handout. (*Main Sources*: Annual IEEE RTSS and RTAS Proceedings, and Real-Time Systems Journal.)