EE249 Design of Embedded Systems
Fall 2007, Homework 1

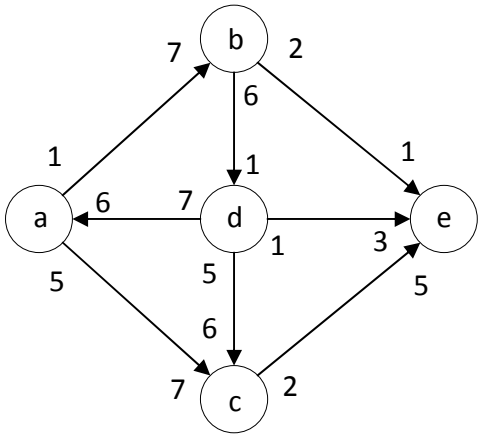
Prof. Alberto Sangiovanni-Vincentelli
Co-instructor: Alessandro Pinto, TA: Qi Zhu
Due in class, Oct. 16, Tuesday, 10% off for up to 1 week late

1. (15 points) What is Platform Based Design (PBD) in your understanding? Could you give two examples of PBD in different application domains?

2. (15 points) Compare Finite State Machines and Data Flow models of computation. How should we choose between them when we model the applications? Please give your reasons and examples.

3. (10 points) Give a (simple) example of two finite state machines whose composition is empty. Show the transition and output relations and the construction used to obtain the output relation for the composition.

4. (20 points) Consider the following synchronous dataflow graph:

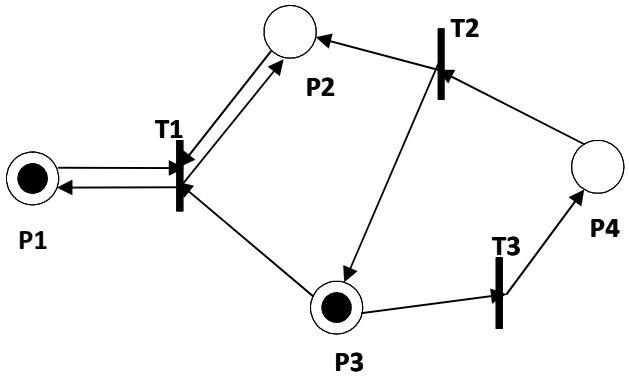


Determine:

- The balance equations and a periodic firing vector.
- A valid single appearance schedule, and add delays on edges (you can choose how) to make the schedule valid.
- The buffer memory lower bound for a *single appearance schedule*, defined in the paper [*Joint Minimization of Code and Data for Synchronous Dataflow Programs* by P. K. Murthy, et al.].
- The lower bound on the amount of memory required by *any* schedule.
- The buffer requirements of your schedule.

- Neglecting the single appearance assumption, find a schedule with lower memory requirements.

5. (20 points) Given the following Petri Net PN1:



- Derive its coverability tree.
- Find a Petri Net PN2 such that:
  - the coverability tree of PN2 is the same as that of PN1.
  - in PN2 marking M=(1,1,0,0) is not reachable from the initial marking M0=(1,0,1,0).

  (A marking M is said to be reachable from a marking M0 if there exists a sequence of transition firings that transforms M0 to M. The algorithm to build the coverability tree can be found in the paper [*Petri Nets: Properties, Analysis and Applications* by T. Murata])

6. (20 points) Using the Tagged Signal Model to model the filter:

$$o(n) = k_1 i(n) + k_2 o(n-1)$$

where n is the index of the samples, k_1 and k_2 are given coefficients. Assume that an initial token (event) $o(0)$ is present and is used by the k_2 multiplier in the first iteration.