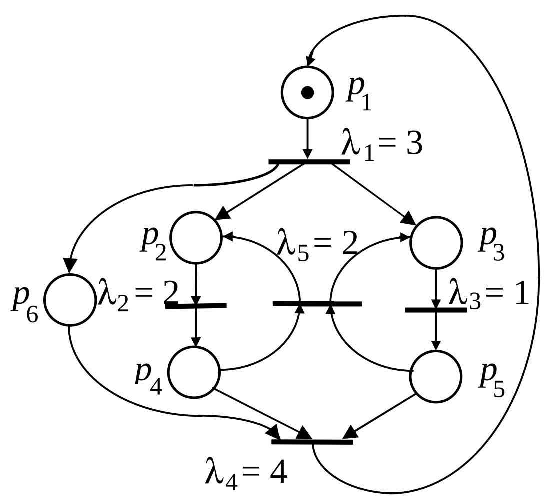
RTDS408 Tutorial Problems #4 - Time Augmented and Stochastic Petri nets

1. We have a data acquisition system that has a single data channel acquired at a clock rate of T_1 = 4 time units. The acquisition time is T_2 = 3 time units and the data is pre-processed by different processes that are activated on alternate data points. These different processes perform data conversion (T_3 = 4 and T_5 = 3 time units respectively) and data normalization (T_4 = 5 and T_6 = 6 time units respectively). The data is then combined (T_7 = 1 time unit) and then a moving average filter process is performed (T_8 = 2 time units). Old data used in the filter process is removed by another process (T_9 = 3 time units) and the final stage records the processed data point (T_{10} = 4 time units).

   For this system, produce a Petri net graph to model all processes and augment it with process time information. Derive the constraints imposed on the process times making use of the notion of *safeness in the presence of time*. Determine if the system can achieve the specified time constraints.

2. Given the following SPN model for a system with the specified transition rates, determine the average time for token return to place p_1.



3. Given the control software for a two machine flexible manufacturing system with one assembly process each sharing a common tool, and the following transition rates:

   $\lambda_1 = 6$ (process 1 waiting)
   $\lambda_2 = 7$ (process 2 waiting)
   $\lambda_3 = 9$ (process 1 active)
   $\lambda_4 = 10$ (process 2 active)

   On average, what fraction of time is the first process using the shared tool as a percentage of the total assembly time?