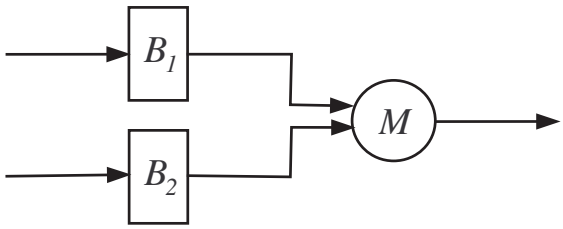
Test of Discrete Event Systems - 08.11.2017

Exercise 1

A manufacturing cell is composed of two one-place buffers B_1 and B_2 and one assembling machine M, as shown in the figure.



Arrivals of raw parts are generated by a Poisson process with rate 10 arrivals/hour. Arriving parts are of type 1 with probability $p = 1/2$ and of type 2 otherwise. Type 1 parts are stored in buffer B_1, whereas type 2 parts are stored in buffer B_2. An arriving part is rejected if the corresponding buffer is full. Machine M assembles one type 1 part and one type 2 part to make a finished product. Assembling starts instantaneously as soon as parts of both types are available in the buffers and M is ready. Assembling times follow an exponential distribution with expected value 5 minutes. The manufacturing cell is initially empty.

1. Model the manufacturing cell through a stochastic timed automaton $(\mathcal{E}, \mathcal{X}, \Gamma, p, x_0, F)$.
2. Assume that M is working and both buffers are full. Compute the probability that the manufacturing cell is empty
   (a) when a new part arrives;
   (b) when a new part is accepted.
3. Compute the average state holding time when B_1 is full, B_2 is empty and M is working.
4. Assume that M is working and both buffers are full. Compute the probability that two products are finished within $T = 10$ minutes, and no arrival of type 1 parts occurs.

Exercise 2

Consider the stochastic timed automaton in the figure, where a and b are events whose lifetimes follow generic probability distributions, and the initial state is $x_0 = 0$.

1. Given $P(X_2 = 1) = 5/8$ and $P(E_2 = a) = 1/3$, compute the probability $p(1|0, a)$.