**TASK 2.1**

Given is the following input sequence of symbols that represent executions of activities (A,B,G,R,X).

\[
111111111 \\
123456789012345678 \\
GAGGAARBBBGRGXABR
\]

a) Use the Expectation-Maximization technique introduced in the lecture to estimate the case IDs for all of the events (at most two E-M-iterations). To initialise the transition matrix, use the formula given in the lecture instead of random initialisation. List the traces that would be identified using this technique.

b) Interpret the results and construct a WF-net system that would be able to produce the derived traces and shows only a few more complete traces.

c) Based on the results, discuss the importance of information on symbols that start a trace or end a trace, respectively. Discuss what would have happened if the first event (G) in the above sequence was lost.

d) Discuss what would have happened if additional information on the process was known in advance:

I. The process is acyclic, i.e., any trace can contain any symbol at most once.

II. The execution of activity A necessarily implies the execution of activity R.
**TASK 2.2**

In many scenarios, the execution of activities takes time, which is abstracted by the atomic notion of transition firing in ordinary Petri net systems. Execution times, however, are one reason why the number of traces that materialize in an event log may be smaller than the number of possible traces of the process model that (truthfully) describes the respective process.

Without considering formal details, assume a simple time model for Petri net systems, in which firing of transitions takes a fixed amount of time. That is, as part of firing a certain transition, tokens are consumed from input places immediately (there is no delay between enabling and firing), but produced on output places only after a certain duration (assuming a global clock).

Consider the following net systems. Identify transitions for which the assignment of a firing duration changes the set of possible traces (or complete traces). Also, discuss assignments that would reduce the size of this set to a minimum.