A benchmark for diagnosis

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This document describes a benchmark for diagnosis proposed for contributors to the special Benchmark Session at WODES’08 (http://www.wodes2008.org).

The benchmark describes a family of manufacturing systems characterized by three parameters: \( n \), \( m \) and \( k \).

- \( n \) is the number of production lines.
- \( m \) is the number of units of the final product that can be simultaneously produced. Each unit of product is composed of \( n \) parts.
- \( k \) is the number of operations that each part must undergo in each line.

To obtain one unit of final product \( n \) orders are sent, one to each line; this is represented by observable event \( t_s \). Each line will produce a part (all parts are identical) and put it in its final buffer. An assembly station will take one part from each buffer (observable event \( t_{e} \)) to produce the final product.

The part in line \( i \) \((i = 1, \ldots, n)\) undergoes a series of \( k \) operations, represented by unobservable events \( \varepsilon_{i,1}, \varepsilon_{i,2}, \ldots, \varepsilon_{i,k} \).

After this series of operations two events are possible: either the part is regularly put in the final buffer of the line, or a fault may occur.

- Putting the part in the final buffer of line 1 corresponds to unobservable event \( \varepsilon_{1,k+1} \), while putting the part in the final buffer of line \( i \) \((i = 2, \ldots, n)\) corresponds to observable event \( t_{i,k+1} \).
- There are \( n - 1 \) faults, represented by unobservable events \( f_i \) \((i = 1, \ldots, n-1)\). Fault \( f_i \) moves a part from line \( i \) to line \( i+1 \). Note that on line \( i \) \((i = 1, \ldots, n-1)\) the fault may only occur when the part has finished processing and is ready to be put in its final buffer; the part goes to the same processing stage in line \( i+1 \).

A Petri net model of this system is shown in Figure 1, where thick transitions represent observable event and thin transitions represent unobservable events.

Design a diagnoser for different values of \( n \), \( m \) and \( k \), specifying the time required to design the diagnoser and the number of states it contains.
Figure 1: The Petri net model of the manufacturing system.