Bayesian Network – Practical Session, Sep 5, 2019, 0900 hrs

In-Class Exercise:

The functioning condition of the emergency diesel generator (EDG) at a nuclear power plant follows a Markov model (i.e. the condition at a time step is only dependent on the condition at the previous time step). The damage condition is given by 7 discrete damage states (D0 to D6). D0 represents the fully functional condition when the EDG is new and D6, the fully damaged condition (failure). For each year that passes:
   (i)   the probability that the condition does not change is 0.4
   (ii)   the probability that the condition deteriorates by one state is 0.3
   (iii)   the probability that the condition deteriorates by two states is 0.2
   (iv)   the probability that the condition deteriorates by three states is 0.1

Model the damage progression of the EDG using a Bayesian network starting from when the EDG is new to the end of a 5-year period (Year 0 to Year 5). Use the network to answer the following questions.

Q1. What is the accumulated probability of failure after 5 years?

Q2. At the end of three years, a deterministic inspection is performed that definitively determines the condition of the EDG to be in condition D2. Given this information, what is the accumulated probability of failure after 5 years?

Bonus *Q3*. Instead of a deterministic inspection, now the inspection after three years has a probability of 0.4, 0.8, 0.9, 0.95, 0.98 and 1 of identifying damage states D1 to D6. This inspection does not detect anything. Now, what is the accumulated probability of failure after 5 years?

Solutions files (in program 'Netica') will be provided via email during the session.

Reference: JCSS Advanced Course on Systems Risk Modelling and Analysis in Engineering Decision Making, May 14-18, 2018, Aalborg University, Aalborg, Denmark