Mark as done

The reliability modelling problems in the lecturer's notes, slides and quizzes should be sufficient to prepare students for the assessments. However below are two additional reliability modelling practice problems for students who wish to practice more examples. These can be regarded as the most complex that students can expect as part of the scope of this module.

There are no deadline, submission or contribution to your semester mark - these practice problems are soley for practice purposes.

There will be no memos distributed for these problems, since that will defeat the purpose of being practices problems. Students who want to attempt these can do so individually, but you are encouraged to form self-determined groups to solve the problems together. Groups (or individuals) are welcome to discuss their attempts with the lecturer during the tutorials of Week 3 and 4 to gauge if they are on the right track for solving the problems - **no attempt on paper, no discussion**.

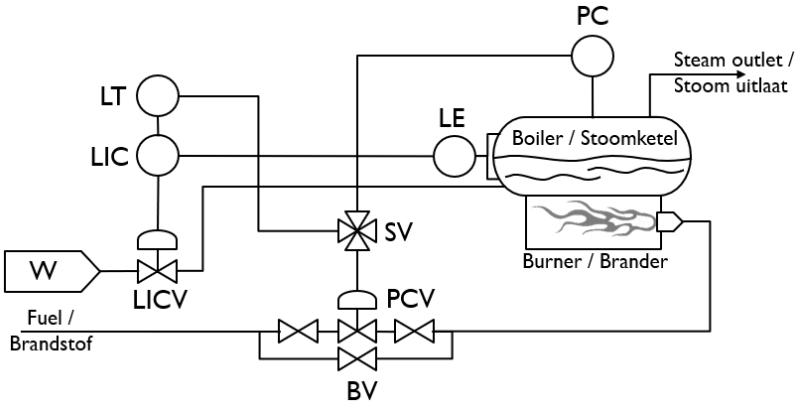
Hint: Do not to overcomplicate the RBD. Do not invent components - all components are designated by the acronyms (e.g. M1, TMB1, LT, PC, ...). It might be that a component appears more than once in different branches.

Practice Problem #1:

An urban rail operator operates various train sets. Each train set has three motor coaches (M1, M2 and M3). M1 and M3 is configured at opposite ends and M2 in the middle of the train set. Between M1 and M2, and M2 and M3 three to five passenger coaches are configured, respectively. The drive system of the train set consists of various components. The propulsion system is an important subsystem of the train set's drive system. Each motor coach has an identical propulsion system and two of these systems are required for the trainset's drive system to function successfully. Each motor coach has two wheel sets. The one wheel set connects wheels 1 and 2 via an axis, while the other consists of wheels 3 and 4. The propulsion system consists of the pantograph (P) that runs against a high voltage overhead cable supplying the power. The pantograph is connected via a series of line switches (LS) to a traction motor controller (TMC), which then connects to the traction motors on the wheel sets. Each wheel has a traction motor (TM1-4) and at least one wheel set with both traction motors operating is required for the propulsion system to function properly. In addition, traction motors, TM1 and TM2 share a common traction motor blower 1 (TMB1) which it cannot operate successfully without. Similarly, TM3 and TM4 requires traction motor blower 2 (TMB2) for successful operation. Finally, the propulsion system is connected to a compressor (C) and reverser (R), which are both required for successful operation. Construct the reliability block diagram.

Practice Problem #2:

The figure shows a steam boiler sytem which supplies steam to a process system.



Water (W) is led to the boiler through a pipeline with a level indicator controller valve (LICV). Fuel is supplied to the boiler's burner, which is fed to the burner chamber through a pipeline with a pressure controller valve (PCV). The PCV is installed in parallel with a bypass valve (BV) together with two isolation valves to facilitate inspection and maintenance of the PCV during normal operation. The BV is however not designed for system redundancy, but is required for a fully functioning PCV. The level of the water in the boiler is meausured by a level emitter (LE). The water level is maintained in an interval between a specified low and high level by a level indicator controller (LIC) which translates the signal from the LE and determines the signal send to the LICV. It is important that the water level does not drop below the specified low level. When the LE measures the water level approaching the low level the LIC sends a signal to the level transmitter (LT), which sends a signal to the solenoid valve (SV). The SV controls the PCV and is designed to cut off the fuel supply in the case the water level comes below the specified low level. In addition the pressure of the boiler is measured by a pressure controller (PC) which is connected to the SV. This circuit is installed to cut off the fuel supply in case the pressure in the boiler increases above a specified high pressure resulting from a boiled dry boiler. The system will be in a state of failure if the monitoring systems fail to shut down the fuel supply when the water level is too low or the pressure in the boiler is too high. Draw the reliability block diagram of the monitoring system.

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