Part II: Application of concepts

Question 4 (14 Points): Markov Modelling

Consider the 2 given Markov models below. They depict a pump system with two pumps, P1 and P2, where P2 runs in a **cold** standby (P1 = ON with a workload of 100%, P2 = OFF with a workload of 0%). If P1 fails, P2 will be switched ON and overtake the complete workload immediately. The Pumps are identical and have a failure rate of 0 at a workload of 0% and a failure rate of 2 per year ($\lambda = 2/365$ d) at a workload of 100%. If both pumps fail the whole pump system fails. The 2 Markov models depict different repair strategies:

1. Both pumps have to be repaired together

2. Each pump has to be repaired separately after a failure

b) (21 Points) Derive the differential equations for both Markov models and determine a steady state analysis for both models. Assume $\lambda = 2/365$ d and $\mu = 1/d$. Give a statement which repair strategy is the best w.r.t. a lower probability of the system's fail state.

Hint: For calculating the stationary availability t is approximated to infinity. In this case we can set the differential equations to $0 (dP_{Sx}(t)/dt=0)$ and we get constant probability values ($P_{Sx}(t) = P_{Sx}$). So we get a homogeneous linear equation system.

