

Exercise 26 (22/12/98 ex..3)

A control unit for the solar panels of an arctic weather station can roughly be described as being in 3 different conditions

Low load When the unit is working under low load it will change to working under high load with intensity $\frac{1}{5} \text{ day}^{-1}$, while it will change to maintainance with intensity $\frac{1}{20} \text{ day}^{-1}$.

High load When the unit is working under high load it will change to working under low load with intensity $\frac{1}{3} \text{ day}^{-1}$, while it will change to maintainance with intensity $\frac{1}{6} \text{ day}^{-1}$.

Maintainance A unit will always start working in the low load condition immediately after maintainance. Maintainance of a unit will be completed with intensity $\frac{1}{7} \text{ day}^{-1}$.

All intensities described above can be considered constant and thus independent of the time elapsed while the unit has been working in the current state.

Question 1

Formulate a mathematical model describing the function of the control unit.

Question 2

Determine the fraction of time used for maintainance (long run average).

Now assume that maintainance is just completed.

Question 3

Determine the distribution of time until the next time the unit will be given maintainance.

Question 4

Determine the mean of the time until next maintainance of the unit.

Actualy maintainance can be either routine maintainance or enhanced maintainance which is equivalent to the repair of some sort of failure. This implies a more detailed examination of some of the previous described intensities.

Low load When working under low load the unit will change to routine maintainance with intensity $\frac{1}{25} \text{ dag}^{-1}$.

High load While working under high load the unit will change to routine maintainance with intensity $\frac{1}{12} \text{ dag}^{-1}$.

All other parts of the model is as described before.

Question 5

Given the unit is working under low load determine the probability that the next condition (i.e. after the first change of state) will 1) work under high load 2) be at routine maintainance 3) be at enhanced maintainance.

Question 6

Calculate the probability that a unit working under high load will get routine maintainance, the next time it will get maintainance.