EXERCISE SESSION 3

AVAILABILITY AND MAINTENABILITY

EXERCISE 1 (Green Book, Exercise 6.1)

A compressor is designed for $T_d = 5$ years of operation. There are two significant contributions to the failure. The first is due to wear (W) of the thrust bearing and is described by a Weibull distribution

$$f(t) = \frac{m}{\vartheta}\left(\frac{t}{\vartheta}\right)^{m-1} e^{\left[-\left(\frac{t}{\vartheta}\right)^{m}\right]}$$

with $\vartheta = 7.5$ year and $m = 2.5$. The second, which includes all other causes (O) is described by a constant failure rate of $\lambda_0 = 0.013$ (year)-1.

1. What is the reliability at 5 years if no preventive maintenance is performed over the 5 years design life?
2. What is the reliability at 5-year if only one preventive maintenance is performed after 2.5 year?
3. If the reliability of the 5-year design life is to be increased to at least 0.9 by periodically replacing the thrust bearing, how frequently must it be replaced?
4. Suppose that the probability of fault bearing replacement causing failure of the compressor is $p = 0.02$. What will the design-life reliability be with the replacement program decided in 3)?

EXERCISE 2 (Green Book, Exercise 6.2)

Consider a safety system made by a one-out-of two system of identical components with constant failure rate λ. The testing and repair of each component last for τ_r hours.
In the sequential maintenance scheme, the two components are tested one after the other, τ being the time between the end of the previous maintenance of the second component and the beginning of the next maintenance of the first one (in other words, every τ hours we test both components in sequence). Find the average unavailability of the system.