

Assignment 2:

Deadline: April 3, 17:00, 2023

Objectives:

You are tasked with the development of tools to guide maintenance decision making for a variety of machines. You have been given historical reliability data for three machines, and are asked to analyse this data. The objective is to determine the failure behaviour of these machines, and to suggest a suitable maintenance strategy to minimize maintenance costs.

You are given historic maintenance data for all three machines, containing the times of any previous maintenance interventions, and a corresponding specification indicating whether this maintenance intervention was preventive or corrective.

Furthermore, you are given historic condition data for the third machine. You are asked to review this data as well, to explore the viability of a condition-based maintenance policy. Therefore, your tool needs to be able to calculate the costs corresponding to such policies.

More machines may need to be analysed in the future, and you are therefore expected to develop tools that will function for future use cases as well.

Deliverables:

The deliverables consist of two parts.

1. Data analysis tool

First, you will develop a data analysis tool in Python. This tool should be able to use the historical data that you are given, in order to provide the following for each machine:

- Kaplan-Meier estimates of the reliability function.
- An estimate of a Weibull reliability function, based on maximum likelihood estimates of the two parameters of the Weibull distribution.
- One figure showcasing both of these estimates.
- The MTBF corresponding to both the Kaplan-Meier and Weibull estimates.
- A figure showing the mean cost per unit time of an age-based maintenance policy as a function of the maintenance age T .

Furthermore, since you are also given condition data for the third machine, your tool should also be able to provide:

- The mean cost per unit time of a condition-based maintenance policy, for any given maintenance threshold, based on simulation.
- A figure showing these costs for different values of this threshold.

We expect you to be able to analyse any dataset that follows the same structure as the one you are given. In order to help you build this tool, we have made a manual, which should help guide you through the process. Make sure you read this manual, as we have several requirements on the naming and structuring of your tool.

2. Managerial summary

Based on the insights that you gained from your tool, you will write a managerial summary. In this summary you should report the information you gained from your tool, but you should at minimum discuss:

- Descriptives of the machines (MTBF, figures of the reliability functions)

- Which maintenance strategy you suggest for each machine.
- What the optimal maintenance age is for each machine.
- What the optimal maintenance threshold is for the third machine.
- The percentage cost savings that you can achieve through the optimal age-based or condition-based maintenance policy in comparison to a pure corrective maintenance policy.

Your managerial summary should be self-contained and should consist of **at most 1000 words** (excluding figures and/or tables).