# TPK4140 - Maintenance Management

## Maintenance optimization problems

**Problem 1 – Replacement of timing belt**



The timing belt of a car is a critical component. If it fails, there is a large risk that this causes serious damages to the engine. In this problem we assume the following:

* MTTFWO = 175 000 km (WO means Without Maintenance, i.e., the MTTF if we do not replace the timing belt preventively)
* α = 3 = aging (shape) parameter in the Weibull distribution
* *C*PM = NOK 7 000 (Cost of preventively replacing the timing belt)
* *C*CM = NOK 35 000 (Cost if the timing belt fails, i.e., major damages to the engine)

Find the optimal interval for replacing the timing belt by using the following methods:

1. Analytical, i.e., taking derivatives and set equal to 0
2. Graphical solution
3. Numerical solution (for example the Excel Solver)

**Problem 2 – Continued**

The problem is more realistic if we include the following assumptions:

* Pr(Need to rent a car|Breakdown) = 0.1
* Cost of renting a car = NOK 5000
* Pr(Overtaking |Breakdown) = 0.005
* Pr(Collision|Overtaking |Breakdown)=0.2
* CCollision = NOK 25 million

Find the optimal interval in this situation, and compare to Problem 1