Rules for evaluation of the exam in TMA4275 Lifetime analysis June 2nd 2023

This document specifies how the solutions to the exam are evaluated. This document should be read together with the problem text and the solution sketch. The solutions are evaluated by assigning points for the answer in each item of the solution. The points for each item are added together and therafter scaled so that the maximum possible score becomes 100 points. The number of points is thereafter converted to a letter grade according to the conversion rule specified at the end of this document.

In the following we specify rules used to assign points to each of the items in the problem text. For each item the maximum number of points possible is ten.

1. Four point are given for computing the Kaplan-Meyer estimates correctly, three points for making a plot of the estimated survival curve, and three points for finding the median survival time (and illustrating it correctly in the plot).

   If including steps also at censored times when computing the Kaplan-Meyer estimates, maximimally one point is given for this part. If the estimated survival curve is not plotted as a staircase two points are subracted, and if the estimated survival curve is not starting at unity, maximally one point is given to that part. If illustration of the median survival time is missing or is wrong, up to two points can be subtracted.

2. Five points for finding the hazard rate correctly, and five points for finding the survival function correctly. No subraction of points for making one or two minor errors in the derivations. Two points for each part if starting out with correct formulas for $\alpha(t)$ and $S(t)$, but doint the integration and the differentation completely wrong.

3. This problem consists of four parts. *i*) Show that $\widehat{A}(t) - A^\star(t) = \int_0^t \frac{J(s)}{Y(s)} dM(s)$, *ii*) Explain why $\widehat{A}(t) - A^\star(t)$ is a mean zero martingale, *iii*) Find expression for $[\widehat{A} - A^\star](t)$ and show that $[\widehat{A} - A^\star](t) = \widehat{\sigma}^2(t)$, and *iv*) Explain why this implies that $\widehat{\sigma}^2(t)$ is an unbiased estimator of the variance of $\widehat{A}(t) - A^\star(t)$.

   Three points are given for solving one of these parts correctly, six point are given for solving two parts correctly, eight points for solving three parts correctly, and ten points for solving all parts correctly. In each of the four parts, one point can be subtracted for minor errors.

4a) Ten points for a correct derivation. Subtract two points for not explicitely saying that $\mathcal{R}_j = \{1, \dots, n\}$ since all components are always under risk. Subract also points also if doing shortcuts in the derivation so that it is unclear whether one really has understood what is happening.

4b) The solution of this problem consists of four parts, *i*) finding partial derivatives, *ii*) correctly solving $\frac{\partial \ell}{\partial \beta_1} = 0$ with respect to β_1, *iii*) argument for why it is not possible to find analytical solution, and *iv*) find expression for profile likelihood.

   Three points are given for solving one of these parts correctly, six point are given for solving two parts correctly, eight points for solving three parts correctly, and ten points for solving all parts correctly.

5a) The problem conists of three parts, *i*) finding the intensity process for a female who was 45 years when MGUS was detected, *ii*) finding confidence interval for k, and *iii*) discuss whether an exponential regression model would fit.

   Three points are given for the first part, four points for the second, and three point for the third. One point is subtracted if the estimated standard deviation for τ is used as an estimate for the variance when computing the confidence interval for k. No points are given for the last part unless a discussion about the uncertainty of k is included, for example by refering to the confidence interval for k.

5b) Three points for correctly finding the formulas for the partial derivatives. Three points for correctly finding the value of $\widehat{S}(10\ 000)$. Four points for correctly explaining how one can find a confidence interval for $S(10\ 000)$.

The aggragated number of points is converted to a letter grade according to the following table.

Points	Letter grade
$(88, 100]$	A
$(76, 88]$	B
$(64, 76]$	C
$(52, 64]$	D
$(40, 52]$	E
$[0, 40]$	F