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Repository: https://github.com/Xuqs97/IDA-Assignment-2.git

Question 1a

We have  and . So 



The contribution to the likelihood from a non-censored observation is. For the censored observations, all we know is that Y>C and so its contribution to the likelihood is

. Since each observations are independent, the likelihood should be:



Where 

The corresponding loglikelihood should be:



We thus have



Leading to



Question 1b

We have



The expected information is . Note that R is a binary random variable so



Therefore,



Question 1c

95% CI:

Question 2a

The contribution to the likelihood from a non-censored observation is . For the censored observations, all we know is that Y<D and so its contribution to the loglikelihood is . Since each observations are independent, the loglikelihood should be:



Question 2b

The maximum likelihood estimate of *μ* based on the data is



Question 3

1. The missing data are MAR and the parameter of missingness mechanism and θ (data model) are distinct/disjoint.
2. The missing data are MNAR so they are not ignorable for likelihood-based estimation.

(c) The missing data are MAR. But the parameter mu1 of missingness mechanism and θ (data model) are NOT distinct/disjoint. So they are not ignorable for likelihood-based estimation.

Question 4

Assume that the first m values of Y are observed and the remaining n-m are missing. We have thatand. The likelihood for  of the complete data is given by



The corresponding loglikelihood is



At iteration t+1 of the iterative procedure, the E-step calculates the conditional expectation, with respect to the missing observations, of the complete data loglikelihood given the observed data and the estimate of  from iteration t, that is



Here, since , we can get .

Then, I use the maxLik package for M-step. And the result is

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Question 5a

The observed data likelihood is



With corresponding log likelihood given by



This log likelihood is difficult to maximize due to the sum inside the logarithm. If we knew the group each observation belons to , we could simply fit a normal distribution to each group. We define an augmented complete dataset where and is a vector of unobserved/latent group data indicator, such that

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Then, the complete data likelihood is



For the E-step we would need to compute



Now,



Thus,



For the M-step,









Question 5b

The maximum likelihood estimates for each component for theta are



