1. R-Lab§8.9.1 Problems 1-3.

2. §8.10 Exercises, Problems 1-2.

3. This problem is more or less like R-Lab §8.9.2, but we will use different bivariate data and my R code (HW04.R) instead of book's.

   The data to be used are weekly returns of two entertainment companies, Comcast (CMCSA) and Paramount (PARA) from Jan 1, 2011 to Sep 14, 2024. The R code is given in HW04.R. Note that the returns in `yt` are in %. Use the first section of the R code to get the data.

   (a) Fit the univariate t model to in each series of `yt`. Compute Person, Spearman and Kendall correlations of `yt`. Would you consider a copula model or bivariate-t model for the data? Explain.

   (b) Take probability transformation for each series and combine them as an $n \times 2$ matrix called `ut`. Plot histogram of `ut` series and scatter plot of the 2 series. Comment on these plots.

   (c) Follow the code given in HW04.R to fit 6 copulas to `ut`. The code will store all 6 fits in one object `cops`. You can easily retrieve a fit, e.g. `cops[[1]]` contains the t-copula fit, use `names(cops)` to get the copula names for each `cops[[i]]`. Please note that each `cops[[i]]` is an S4 object. Compute AIC and BIC for each fit.

   (d) Exam each fit with pdf contours overlaying the nonparametric copula pdf contours. The code is given in HW4.R. Do the plots agree with the AIC and BIC values?

   (e) Select a copula model and show its estimates.

   Note: In practice, we will use the selected marginal univariate models and copula family to specify the log-likelihood of the full model with their estimates as starting values to calculate the MLE. An example of configuration using the R package `copula` is given on page 211 of Ruppert and Matteson.

4. Questions 4 and 5. Do the two questions in the attached file "Midterm2021.pdf".