Exercise 8

General instructions: Follow these instructions as they facilitate the revision of the exercises. The review takes into account that you always use the requested file names. Send only the files requested. Return your answers to your assistant as an email entitled TilaI,2017.

If you have not programmed before, choose only one of the programming languages (**octave**/**python**) and don't change it during the course. If you are sure that you want to try both languages, you can of course do the exercises in both languages. However return the exercises to your assistant in one language only.

- **Exercise 8a:** The instructions apply for both **python** and **octave**.

  In the course webpage there are two images. The first image H8aPmalli.pdf is made with **python**. The other image H8aOmalli.pdf is made with **octave**.

  In the lower left corner of each file is a **bigger image**. In the upper right corner of each file is a **smaller image**. The images are made in the following way:

  1. Created 21 time values $t = t_i = 0, 2, 4, 6..., 36, 38, 40$.
  2. Calculated the values $y = y_i = m + a\cos[2\pi(t_i - t_0)/p_1]$, where mean $= m = 8$, amplitude $= a = 0.1$, period $= p_1 = 2.15$ and time offset $= t_0 = -1$.
  3. Calculated the phases phi1 $= \phi_{1,i} = \text{FRAC}[(t_i - t_0)/p_1]$, where $\text{FRAC}[x]$ removes the integer part of value x so that only the decimal part of the value x remains. For example $\text{FRAC}[123.4567] = 0.4567$. Therefore for the phases $0 \leq \phi_i < 1$.
  4. Placed the **larger image to the lower left corner of the plot area**.
  5. Limited the plot in x-direction to between 0 and 1, and in y-direction to between 7.7 and 8.3.
  6. Plotted vector y as a function of vector phi1 using circles as plot symbols.
  7. Wrote the text "ϕ" under the x-axis. Wrote the text "$y(\phi)$" next to the y-axis. Wrote the text "(a)" into the upper right corner of the plot.
  8. Calculated the new phases phi2 $= \phi_{2,i} = \text{FRAC}[(t_i - t_0)/p_2]$, where the new period was $= p_2 = 2p_1$.
  9. Created the error estimates for the observations $e = e_i = 0.04$.
  10. Placed the **smaller image to the upper right corner of the plot area**.
  11. Limited the plot in x-direction to between 0 and 1, and in y-direction to between 7.85 and 8.15.
  12. Plotted vector y and its errors e (vertical bars) as a function of vector phi2 using circles as symbols.
  13. Saved the end result
  in **python** into the file H8aPmalli.pdf
  or
  in **octave** into the file H8aOmalli.pdf.

  Requirements of the exercise 8a
  Write a **python** program H8avalmis.py, that produces an image H8aPvalmis.pdf whose **contents** are similar to the image H8aPmalli.pdf in the course webpage. The program must not crash with the command python H8avalmis.py.

  <div align="center">or</div>

  Write an **octave** program H8avalmis.m, that produces an image H8aOvalmis.pdf whose **contents** are similar to the image H8aOmalli.pdf in the course webpage. The program must not crash with the command octave H8avalmis.m.

  Additional instructions: The larger image should be in the lower left corner of the plot area. The smaller image should be in the upper right corner of the plot area. The image sizes do not have to otherwise match the given models. The symbol color or size, text and number size, etc... do not have to be exactly same as in the models. It is sufficient that the **contents** of the images is the same.
  Tip: The programs from lecture 8 Pmalli13.py and Omalli13.m should be used as models.

- **Exercise 8b:**

  The goal of this exercise is to produce a report about the application of the Rayleigh test to the time values t_i in the file `H7binput.dat`. Your task is to write a **LaTeX** file `H8bvalmis.tex`, from which the command `pdflatex H8bvalmis` produces a file `H8bvalmis.pdf`, whose **contents** match as accurately as possible the model file `H8bmalli.pdf` in the course webpage. The **form** of the result does not have to be the same, only the **contents**. You can for example leave the red colored text as normal black text. The program must not crash with the command `pdflatex H8bvalmis`.

  Copy the files `H7bmodel.dat` and `H9aPmalli.jpg` from the course webpage into the same folder with the file
  `H8bvalmis.tex`.

  Tip: The **LaTeX** environment of the file `H8bmalli.tex` is created with the initial commands

  ```
  \documentclass{article}
  \usepackage[dvips]{graphicx}
  \usepackage{color}
  \usepackage[finnish]{babel}
  \usepackage[utf8]{inputenc}
  \newcommand{\LAT}{{\color{red} \bf \LaTeX}}
  \newcommand{\PYT}{{\color{red} \bf python}}
  \newcommand{\OCT}{{\color{red} \bf octave}}
  \pagestyle{empty}
  \hoffset=-3.5cm
  \textwidth=18.5cm
  \voffset=-3.5cm
  \textheight=27.0cm
  \begin{document}
  ```

  Requirements of the exercise 8b
  The command `pdflatex H8bvalmis` produces a file `H8bvalmis.pdf`, whose **contents** match as accurately as possible the file `H8bmalli.pdf` in the course webpage. The program must not crash with command `pdflatex H8bvalmis`.

Turning in the exercises
Send the files to the assistant attached to the e-mail:
H8a: `H8avalmis.py` & `H8aPvalmis.pdf` or `H8avalmis.m` & `H8aOvalmis.pdf`
H8b: `H8bvalmis.tex` & `H8bvalmis.pdf`