Exercise 6

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**) 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 of both languages. However return the exercises to your assistant in one langugage only.

- **Exercise 6a (LaTeX)**

  Go to your directory `/home/username/latex/`
  From course website copy here files `H2bkesken.tex` and `H6akuva.pdf`
  Copy the first file to a new file using command `cp H2bkesken.tex H6avalmis.tex`.
  Edit file `H6avalmis.tex` so that using commands
  ```
  pdflatex H6avalmis
  pdflatex H6avalmis
  evince H6avalmis.pdf &
  ```
  will result in a similarly looking page to the next page here.
  Specifier 1: You don't need to care for all the little datails. You are looking for an about similar content.
  Specifier 2: In English and Swedish answers row `\usepackage[finnish]{babel}` can be replaced to `\usepackage[english]{babel}` or `\usepackage[swedish]{babel}`, but this is not mandatory. If you decide to do so, do this correction before you first time use command `pdflatex H6avalmis`
  Specifier 3: Text `[h]` is created using command \verb|[h]|, and all the similar text. Specifier 4: Longer parts of similar text is produced in `\begin{verbatim}` and `\end{verbatim}`. environment.

Lets study adding a table and an image to latex document and test referencing to them and making captions. One needs several commands to do that.

First add packet-command `\usepackage{graphicx}` one row before command `\begin{document}`

Write following lines above line `\begin{document}`

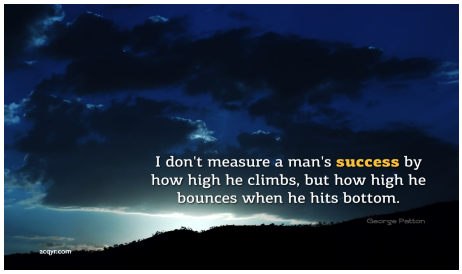
```
\hoffset=-2.0cm
\textwidth=16.0cm
\voffset=-3.0cm
\textheight=26.0cm
\pagestyle{empty}
```

These lines define the width and height of the text and they also define marginals.

The last line removes page numbering.

After that write lines.

```
\begin{figure}[h]
\centering
\includegraphics[width=6.0cm,height=3.5cm]{H6akuva.pdf}
\caption[]{This is my first image. (@wallpaper-kid.com)}
\label{EnsKuva}
\end{figure}
```



Kuva 1: This is my first figure (@wallpaper-kid.com)

This includes picture `H6akuva.pdf` to document. In command `\begin{figure}[h]` part `[h]` forces the picture to be placed where it was written to. Other options include `[t]` (top) and `[b]` (bottom).

After that using `tabular` environment create a table, in which all columns are centered.

A	B	C	D	E	F
1	4900	56	8	89	111
2	1796	345	9	67	34

Do the same table again, but add next lines to the beginning of it.

```
\begin{table}[h]
\begin{center}
\caption{This is my first table}
```

and to the end of it

```
\label{EnsTaulukko}
\end{center}
\end{table}
```

Taulukko 1: This is my first table

A	B	C	D	E	F
1	4900	56	8	89	111
2	1796	345	9	67	34

The result should look similar to above. In command `\begin{table}[h]` part `[h]` Forces the table to be placed to the place it was written to.

At the end reference to the figure and to the table using commands `\ref{EnsKuva}` and `\ref{EnsTaulukko}`. So now I reference to table 1 and figre 1 for the first time.

Requirement of the exercise 6a: Create file `H6avalmis.tex`, that creates the results shown above and doesn't crash using command `pdflatex H6avalmis`.

- **Exercise 6b:** do either **python** or **octave** part

python part

The purpose of this exercise is to learn to use **python** subprograms.

Go to your directory `/home/username/ohjelmat/`. From course website copy **python** program `H6bkesken.py`. Copy it with new name `H6bvalmis.py`. To program `H6bvalmis.py` edit subrograms described below one by one between lines
`# _____ Editoi aliohjelmat taman rivin alapuolelle ________`
and
`# _____ Editoi aliohjelmat taman rivin ylapuolelle ________`

Don't change the command in the lines below them that end with comment `# Ei saa muuttaa`.

The **"input"** for subrograms is
Times $t_i = [t_1, t_2, t_3] = [1, 2, 3] =$ `t`.
Observations $y'_i = [y'_1, y'_2, y'_3] = [4, 5, 6] =$ `ydot`.
Frequencies $f = 1.41 =$ `f`.

First create subprogram, that calculates the value for variable

$$\text{tau} = \tau = \frac{1}{4\pi f} \text{ arc tan}\{\frac{[\sum_{i=1}^{n} \sin(4\pi f t_i)]}{[\sum_{i=1}^{n} \cos(4\pi f t_i)]}\}$$

with command `tau=aliohjelma1(t,f)`
Input is `t` and `f`. Output is `tau`.

Next create subprogram, that calculates values for variables

$$\begin{aligned} z1 = z_1(f) &= \{\sum_{i=1}^{n} y'_i \cos[2\pi f(t_i - \tau)]\}^2 \\ z2 = z_2(f) &= \{\sum_{i=1}^{n} y'_i \sin[2\pi f(t_i - \tau)]\}^2 \end{aligned}$$

with command `z1,z2=aliohjelma2(t,ydot,f,tau)`
Input is `t`, `ydot`, `f` and `tau`. Output is `z1` and `z2`.

You have received the rigth results when command `python H6bvalmis.py` prints
`0.0496453900709 1.14844141687 11.8561720281`

Tip 1: Turn the last two lines of the program `H6bvalmis.py` to comments. Edit program for so long that command `tau=aliohjelma1(t,f)` works. Chech the results for example using commands `print(tau)`. When the first subprogram works, uncomment the last two lines. After this try to make the other subprogram work too. **Tip 2:** Program `Psub2.py` in lecture 6 is a good model.

octave part

The purpose of this exercise is to learn to use **octave** subprograms.

Go to your directory `/home/username/ohjelmat/`. From the course website copy **octave** program `H6bkesken.m`. Copy it with a new name `H6bvalmis.m`. To program `H6bvalmis.m` edit subrograms described below one by one between lines
`# _____ Editoi aliohjelmat taman rivin alapuolelle ________`
and
`# _____ Editoi aliohjelmat taman rivin ylapuolelle ________`

Don't change the commands below in lines that end with comment `# Ei saa muuttaa`.

"input" in subrograms are
Times $t_i = [t_1, t_2, t_3] = [1, 2, 3] =$ `t`.
observations $y'_i = [y'_1, y'_2, y'_3] = [4, 5, 6] =$ `ydot`.
Frequencies $f = 1.41 =$ `f`.

First create a subprogram that calcutes the value for the variable

$$\text{tau} = \tau = \frac{1}{4\pi f} \text{ arc tan}\{\frac{[\sum_{i=1}^{n} \sin(4\pi f t_i)]}{[\sum_{i=1}^{n} \cos(4\pi f t_i)]}\}$$

with command `[tau]=aliohjelma1(t,f);`
Input is `t` ja `f`. Output is `tau`.

Next create a subprogram that calculates values for variables

$$\begin{aligned} \text{z1} = z_1(f) &= \{\sum_{i=1}^{n} y'_i \cos[2\pi f(t_i - \tau)]\}^2 \\ \text{z2} = z_2(f) &= \{\sum_{i=1}^{n} y'_i \sin[2\pi f(t_i - \tau)]\}^2 \end{aligned}$$

with command `[z1,z2]=aliohjelma2(t,ydot,f,tau);`
Input is `t`, `ydot`, `f` and `tau`. Output is `z1` and `z2`.

You have gotten the rigth results when command `octave H6bvalmis.m` prints
`0.049645 1.148441 11.856172`

Tip 1: Change the two last lines of the program `H6bvalmis.m` to comments. Edit program until command `[tau]=aliohjelma1(t,f);` works. Check the results for example using command `disp(tau)`. When the first subprogram is working, uncomment the two last lines. Then try to get the other subprogram to work. **Tip 2:** Program `Osub2.m` in lecture 6 is a good model.

Requirements for the exercise 6b

python Part: Create program `H6bvalmis.py`, that prints the results described above and doesn't crash using command `python H6bvalmis.py`.
octave part: Create program `H6bvalmis.m`, that prints the results described above and doesn't crash using command `octave H6bvalmis.m`.

Turning in the exercises

Send your assistant following files attached to the e-mail
H6a: `H6avalmis.tex` and `H6avalmis.pdf`
H6b: `H6bvalmis.py` or `H6bvalmis.m`