Exercise 7

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 7a:** The instructions apply for both **python** and **octave**.

  From the course webpage copy the files `H7atarkistus.tex`, `H7ainput.dat`, and `H7amodel.dat`.

  The first three lines of the file `H7ainput.dat` are

```
0.013       7.733
1.195       7.690
2.048       7.723
```

  The first three lines of the file `H7amodel.dat` are

```
0.01 &   7.73 &  13.15 &   7.75 &  24.12 &   7.70 &  34.95 &   7.66   \\
1.20 &   7.69 &  14.05 &   7.64 &  25.01 &   7.71 &  35.03 &   7.65   \\
2.05 &   7.72 &  14.09 &   7.65 &  25.04 &   7.71 &  35.93 &   7.75   \\
```

  The file `H7ainput.dat` has one hundred lines. Each line has two numbers given with the accuracy of three decimals. The numbers in the first column are the observation times $t_i = t_1, ..., t_{100}$. The numbers in the second column are the observations $y(t_i) = y_i = y_1, ..., y_{100}$.

  The file `H7amodel.dat` has 25 lines. In the first and the second column are the 25 first $t_i = t_1, ..., t_{25}$ and $y_i = y_1, ..., y_{25}$ values given with the accuracy of two decimals. In the third and the fourth column are the next 25 values $t_i = t_{26}, ..., t_{50}$ and $y_i = y_{26}, ..., y_{50}$, and so on ... The **&** signs between the values separate the table columns as is needed in LaTeX. At the end of each line are the **** signs that end the table lines in LaTeX.

  Write a **python** or **octave** program that reads the file `H7ainput.dat` and writes its contents to a new file `H7aoutput.dat`. The **contents** of `H7aoutput.dat` should be similar to `H7amodel.dat`. Use the name `H7avalmis.py` for your **python** program or the name `H7avalmis.m` for your **octave** program. You can check the output of your program by giving the command

```
pdflatex H7atarkistus
evince H7atarkistus.pdf
```

  If the file `H7aoutput.dat` is of the correct form, the **contents** of the file `H7atarkistus.pdf` will look similar to the next page

  Question 1: What does the command `\input{H7aoutput.dat}` do in the file `H7atarkistus.tex`?

  Requirements of the exercise 7a
  Your program doesn't crash with the command `python H7avalmis.py` or `octave H7avalmis.m`.
  The command `pdflatex H7atarkistus` doesn's crash and produces the file `H7atarkistus.pdf`, whose **contents** are similar to the next page.
  Answer in your e-mail to the assistant briefly to **Question 1.**

  Tip 1: The files `H7atarkistus.tex` and `H7aoutput.dat` should be in the same directory.
  Tip 2: Read t_i and y_i values to the vectors `t` and `y`. Then using the indices split both vectors `t` and `y` to four separate new vectors.
  Tip 3: Use the files `Pmalli10.py` or `Omalli10.m` from lecture 7 as models.

t	y	t	y	t	y	t	y
0.01	7.73	13.15	7.75	24.12	7.70	34.95	7.66
1.20	7.69	14.05	7.64	25.01	7.71	35.03	7.65
2.05	7.72	14.09	7.65	25.04	7.71	35.93	7.75
3.13	7.69	14.99	7.75	25.06	7.71	36.01	7.74
4.16	7.69	15.02	7.75	25.08	7.71	37.98	7.76
5.03	7.70	15.03	7.75	25.99	7.68	38.93	7.66
5.14	7.71	15.10	7.75	26.06	7.70	39.05	7.65
5.17	7.73	16.00	7.64	26.10	7.70	40.07	7.75
6.15	7.67	17.00	7.75	26.93	7.71	40.91	7.64
6.16	7.69	17.08	7.75	27.05	7.70	40.93	7.66
6.17	7.67	17.98	7.65	28.05	7.71	41.97	7.75
7.04	7.70	18.97	7.76	29.02	7.70	42.01	7.75
7.98	7.69	19.00	7.75	30.92	7.68	42.03	7.74
8.07	7.68	19.01	7.74	30.93	7.68	42.04	7.74
9.15	7.74	19.09	7.74	31.01	7.67	42.93	7.65
9.99	7.67	19.12	7.73	31.05	7.67	43.91	7.75
10.06	7.66	19.12	7.74	31.06	7.68	43.97	7.73
10.06	7.67	19.14	7.74	31.11	7.66	44.92	7.67
11.12	7.74	19.98	7.65	31.92	7.72	45.89	7.73
11.12	7.74	20.12	7.67	32.03	7.74	45.91	7.73
11.15	7.75	20.14	7.67	33.08	7.66	45.99	7.72
12.08	7.65	20.95	7.74	33.10	7.66	46.01	7.72
12.15	7.65	22.08	7.67	33.95	7.74	46.93	7.67
12.97	7.74	22.98	7.74	33.97	7.73	46.99	7.68
13.10	7.75	24.00	7.67	34.94	7.66	47.98	7.71

- **Exercise 7b:** **python** or **octave** part instructions are same, because the goal of the exercise is same.

  From the course webpage copy the files `H7btarkistus.tex`, `H7binput.dat`, and `H7bmodel.dat`.

  The first three lines of file `H7binput.dat` are

```
1.080  1.
1.240  1.
1.400  1.
```

  The first three lines of the file `H7bmodel.dat` are

```
 1.08 &  31.26 &  65.09 &  97.47 & 128.28 & 156.09 & 190.26 & 239.08 & 274.36 & 314.07 & 346.38 \\
 1.24 &  31.43 &  65.27 &  98.09 & 128.47 & 156.27 & 190.43 & 239.23 & 277.07 & 314.22 & 347.38 \\
 1.40 &  32.09 &  65.46 &  98.28 & 132.09 & 156.46 & 191.09 & 239.38 & 277.22 & 314.36 & 348.08 \\
```

  The last three lines of the same file `H7bmodel.dat` are

```
29.25 &  62.09 &  94.47 & 127.28 & 154.09 & 188.26 & 238.08 & 272.36 & 308.07 & 345.38 &  \\
29.43 &  62.27 &  97.09 & 127.47 & 154.28 & 188.43 & 238.23 & 274.07 & 308.22 & 346.08 &  \\
31.09 &  62.45 &  97.28 & 128.09 & 154.46 & 190.09 & 238.38 & 274.22 & 308.36 & 346.23 &  \\
```

  The file `H7binput.dat` has 528 lines. Each line has two numbers. The numbers in the first column are given with the accuracy of three decimals. The numbers in the first column are the moments of time $t_i = t_1, ..., t_{528}$. All values in the second column are ones. The values in the second column have no meaning in this context, so they should be left unread.

  The file `H7bmodel.dat` has 50 lines. In the first column are the 50 first moments of time values $t_i = t_1, ..., t_{50}$ at the accuracy of two decimals. In the second column are the next 50 values $t_i = t_{51}, ..., t_{100}$. In the last 11th column in the first 28 lines are the numerical values $t_i = t_{501}, ..., t_{528}$. In the subsequent lines of column 11 there are no values, because the data "runs out" The `&` signs separate the table columns as is needed in LaTeX. At the end of each line are the `\\` signs that end the table lines in LaTeX.

  Write a **python** or **octave** program that reads the file `H7binput.dat` and writes its contents to a new file `H7boutput.dat`. The **contents** of `H7boutput.dat` should be similar to `H7bmodel.dat`. Use the name `H7bvalmis.py` for your **python** program or the name `H7bvalmis.m` for your **octave** program. You can check the output of your program by giving the command

```
pdflatex H7btarkistus
evince H7btarkistus.pdf
```

  If the file `H7boutput.dat` is of the correct form, the **contents** of the file `H7btarkistus.pdf` will look similar to the next page

  Requirements for the exercise 7b
  Your program doesn't crash using command `python H7bvalmis.py` or `octave H7bvalmis.m`.
  The command `pdflatex H7btarkistus` doesn't crash and produces the file `H7btarkistus.pdf`, whose **contents** are similar to the next page.

  Tip 1: The files `H7btarkistus.tex` and `H7boutput.dat` should be in the same directory.
  Tip 2: Read t_i values to vector `t`. Then using the indices split the vector `t` to eleven separate new vectors. The last eleventh vector will have 28 elements while the ten first vectors have 50 elements.
  Tip 3: Use the files `Pmalli10.py` or `Omalli10.m` from lecture 7 as models.
  Tip 4: Try to write inside the `for` loop writing to the file a suitable `if` structure, that takes into account the last eleventh vector's exceptional length, which is 28 elements.

t	t	t	t	t	t	t	t	t	t	t
1.08	31.26	65.09	97.47	128.28	156.09	190.26	239.08	274.36	314.07	346.38
1.24	31.43	65.27	98.09	128.47	156.27	190.43	239.23	277.07	314.22	347.38
1.40	32.09	65.46	98.28	132.09	156.46	191.09	239.38	277.22	314.36	348.08
2.08	32.26	66.09	98.47	132.28	157.09	191.26	242.08	277.36	320.07	348.23
2.24	32.43	66.27	99.09	132.47	157.27	191.43	242.23	278.07	320.22	348.38
3.08	33.26	66.46	99.28	134.09	157.46	192.09	242.38	278.22	320.37	350.08
3.24	35.09	69.09	99.47	134.28	158.09	192.26	245.08	278.36	323.07	350.23
4.08	35.26	69.28	100.09	134.47	158.27	192.43	245.23	279.07	323.22	350.39
4.24	35.43	69.46	100.28	135.09	158.46	197.08	245.38	279.22	323.37	351.08
4.40	37.09	70.09	100.47	135.28	160.09	197.25	246.08	279.36	324.07	351.23
5.40	37.26	70.28	102.09	135.47	160.27	197.42	246.23	281.07	324.37	351.39
6.08	37.43	70.46	102.28	137.09	160.45	202.08	246.38	281.22	325.07	353.08
6.24	38.09	75.09	102.47	137.28	161.09	202.25	248.07	281.36	325.22	353.23
6.40	38.26	75.28	103.09	137.47	161.27	202.42	248.23	282.07	325.37	353.39
7.08	38.43	75.46	103.28	140.09	161.45	207.08	248.38	282.22	328.07	354.08
7.24	39.09	80.09	103.47	140.28	163.27	207.25	255.07	282.36	328.22	354.23
8.08	39.26	80.28	105.09	140.47	163.45	207.41	255.22	283.07	328.37	354.39
8.24	39.44	80.47	105.28	141.09	166.09	208.08	255.37	283.22	329.07	355.08
8.41	40.09	83.09	105.47	141.28	166.27	208.25	256.07	283.36	329.22	355.39
9.08	40.26	83.28	110.47	141.47	166.45	208.41	256.22	285.07	329.37	357.08
9.24	40.44	83.47	111.09	142.09	168.09	209.08	256.37	285.21	331.07	357.24
9.41	42.09	84.09	111.28	142.28	171.09	209.25	257.07	285.36	331.22	357.39
12.08	42.26	84.28	111.47	142.47	171.27	209.41	257.22	290.36	331.37	358.08
14.08	42.44	84.47	112.09	143.09	171.44	211.08	257.37	292.07	333.37	358.24
17.08	43.09	85.09	112.28	143.28	172.09	211.25	258.07	292.21	334.07	358.39
17.25	43.26	85.28	115.09	143.47	172.27	211.41	258.22	292.36	334.22	359.08
17.41	43.44	85.47	115.28	144.09	172.44	213.08	258.37	293.07	334.37	359.24
18.08	44.09	86.09	115.47	144.28	174.09	213.24	261.07	293.21	337.07	359.39
18.25	45.09	86.28	116.09	144.47	174.26	213.41	261.22	293.36	337.23	
18.41	45.26	86.47	116.28	146.09	174.44	216.08	261.37	294.07	337.38	
20.08	45.44	87.09	119.09	146.28	177.09	216.24	262.07	294.21	338.07	
20.25	46.09	87.28	119.28	146.46	177.26	216.40	262.22	294.36	338.23	
20.42	46.27	87.47	119.47	147.09	177.44	217.08	262.37	297.07	338.38	
23.08	46.44	88.09	121.09	147.28	181.09	217.24	264.07	297.21	339.07	
23.25	48.09	88.28	121.28	147.46	181.26	217.40	264.22	297.36	339.23	
23.42	48.27	88.47	121.47	148.09	181.44	224.08	264.37	298.07	339.38	
24.08	48.44	89.09	122.09	148.28	183.09	224.24	265.07	298.21	341.08	
24.25	50.45	89.28	122.28	148.46	184.09	224.40	265.22	298.36	341.23	
26.09	57.09	89.47	122.47	149.09	184.26	225.08	265.37	299.07	341.38	
26.25	57.27	91.09	123.09	149.28	184.43	225.24	268.07	299.21	342.08	
26.42	57.45	91.28	123.28	149.46	185.09	225.40	268.22	299.36	342.23	
27.09	58.09	91.47	123.47	151.09	185.26	228.08	268.36	301.07	342.38	
27.25	58.27	93.09	124.09	151.28	185.43	228.24	269.07	301.21	343.08	
27.42	58.45	93.28	125.09	151.46	187.09	228.39	269.22	301.36	343.23	
28.25	59.09	93.47	125.28	153.09	187.26	237.08	269.36	303.07	343.38	
28.43	59.27	94.09	125.47	153.28	187.43	237.23	272.07	303.22	345.08	
29.09	59.45	94.28	127.09	153.46	188.09	237.38	272.22	303.36	345.23	
29.25	62.09	94.47	127.28	154.09	188.26	238.08	272.36	308.07	345.38	
29.43	62.27	97.09	127.47	154.28	188.43	238.23	274.07	308.22	346.08	
31.09	62.45	97.28	128.09	154.46	190.09	238.38	274.22	308.36	346.23	

Turning in the exercises

Send the files to the assistant attached to the e-mail:

H7a: `H7avalmis.py` or `H7avalmis.m`

H7b: `H7bvalmis.py` or `H7bvalmis.m`

H7a: Brief answer to **Question 1**.