

NUR solution template

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Abstract

In this document an example solution template is given for the exercises in the course Numerical recipes for astrophysics.

1 Sine exercise

In this section we look at question 1 subquestion a, we want to add this extra explanation bla bla, and also note bla bla.

Our script is given by:

```
1 #!/usr/bin/env python3
2 import numpy as np
3 import matplotlib.pyplot as plt
4
5 # allocate x array
6 x = np.linspace(0,2*np.pi)
7
8 # define and allocate y array
9 y = np.sin(x)
10 y2 = np.cos(x)
11
12 plt.plot(x,y,label='Sine')
13 plt.plot(x,y2,label='Cosine')
14 plt.legend()
15 plt.xlabel('x variable')
16 plt.ylabel('y variable')
17 plt.savefig('./plots/sineplot.png')
18 plt.close()
```

sine.py

Our script produces the following results, see Fig. 1, compare with literature in Fig. 2.

2 Hello world exercise

```
1 #!/usr/bin/env python3
2
3 # print what we want to print
4 print("Hello world!")
5 print("This is an example for output")
6 print("That is piped to an output file")
7 print("And afterwards displayed in your pdf")
```

helloworld.py

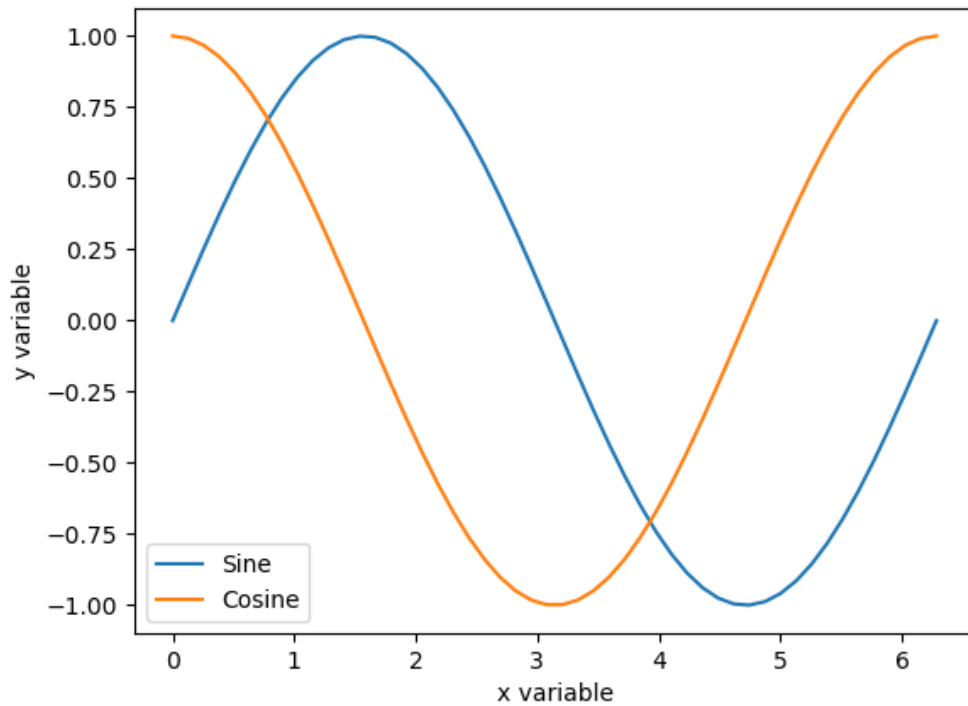


Figure 1: The result of our program, as can be seen the sine and cosine are behaving exactly as expected, there for we can conclude

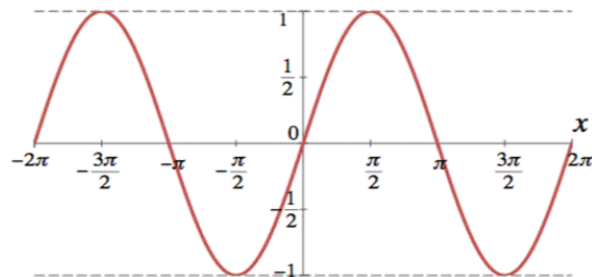


Figure 2: Literature result, say something...

3 cosine question

The file of this exercise is:

```

1 #!/usr/bin/env python
2 import numpy as np
3
4 # program to check values at specific variables of cosine
5 x = np.array([0, np.pi/2, np.pi])
6 y = np.cos(x)
7
8 # Save a text file
9 np.savetxt('cosoutput.txt', np.transpose([x,y]))

```

cos.py

The result of the script is given by:

```
1 0.0000000000000000e+00 1.0000000000000000e+00
2 1.570796326794896558e+00 6.123233995736766036e-17
3 3.141592653589793116e+00 -1.0000000000000000e+00
```

cosoutput.txt

4 Sine movie exercise

For exercise we needed to make a movie, bla bla. Done with:

```
1 #!/usr/bin/env python3
2 import numpy as np
3 import matplotlib.pyplot as plt
4 from tqdm import tqdm
5
6 x = np.linspace(0,2*np.pi,100)
7
8 for i in tqdm(range(0,300)):
9     y = np.sin(x+np.pi*i/300.)
10    plt.plot(x,y)
11    plt.xlabel('x axis')
12    plt.ylabel('y axis')
13    plt.savefig('./plots/snap%04d.png'%i)
14    plt.close()
```

sinemovie.py

For the movie see the main directory the file `sinemovie.mp4`.

5 Exercise that fails

I tried several things, bla bla, code doesn't seem to work

```
1 #!/usr/bin/env python3
2 import numpy as np
3
4 print("fail")
```

failex.py