

# Ph 20 Assignment 1

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6 October 2017

## 1 Assignment 4 Info

### 1.1 Logs and such

```
commit b93ae5712dbdc690c00d9362b544e5da25685467 (HEAD -> master, origin/master)
```

```
Author: David Shlivko <Dave@Davids-MacBook-Pro.local>
```

```
Date:   Fri Nov 10 13:40:58 2017 -0800
```

Part 2 Added

```
commit b76e482ade06a8dc2f8d80c6bf3c384bc22bc19d
```

```
Author: David Shlivko <Dave@Davids-MacBook-Pro.local>
```

```
Date:   Fri Oct 27 14:25:10 2017 -0700
```

LaTeX altered

```
commit 8cfceabb389dcde26e88f44f8dcc7a6773285947
```

```
Author: David Shlivko <Dave@Davids-MacBook-Pro.local>
```

```
Date:   Fri Oct 27 13:53:43 2017 -0700
```

First commit

```
python Assignment1copy.py 1 1 1 1 0 0.01 100 1 1
```

```
python Assignment1copy.py 1 1 1 1 20 0.01 100 1 2
```

```
python Assignment1copy.py 1 1 1 1 20 0.01 100 0 3
```

```
pdflatex -shell-escape -interaction=nonstopmode -file-line-error Assignment1.tex
```

```
This is pdfTeX, Version 3.14159265-2.6-1.40.16 (TeX Live 2015) (preloaded format=pdflatex)
\write18 enabled.
```

```
entering extended mode
```

```
(./Assignment1.tex
```

```
LaTeX2e <2015/01/01>
```

```
Babel <3.91> and hyphenation patterns for 79 languages loaded.
```

```
(/usr/local/texlive/2015/texmf-dist/tex/latex/base/article.cls
```

```
Document Class: article 2014/09/29 v1.4h Standard LaTeX document class
```

```
(/usr/local/texlive/2015/texmf-dist/tex/latex/base/size10.clo))
```

```
(/usr/local/texlive/2015/texmf-dist/tex/latex/amsmath/amsmath.sty
```

```
For additional information on amsmath, use the '?' option.
```

```
(/usr/local/texlive/2015/texmf-dist/tex/latex/amsmath/amstext.sty
```

```
(/usr/local/texlive/2015/texmf-dist/tex/latex/amsmath/amsgen.sty))
```

```
(/usr/local/texlive/2015/texmf-dist/tex/latex/amsmath/amsbsy.sty)
```

```

(/usr/local/texlive/2015/texmf-dist/tex/latex/amsmath/amsopn.sty)
(/usr/local/texlive/2015/texmf-dist/tex/latex/graphics/graphicx.sty
(/usr/local/texlive/2015/texmf-dist/tex/latex/graphics/keyval.sty)
(/usr/local/texlive/2015/texmf-dist/tex/latex/graphics/graphics.sty
(/usr/local/texlive/2015/texmf-dist/tex/latex/graphics/trig.sty)
(/usr/local/texlive/2015/texmf-dist/tex/latex/latexconfig/graphics.cfg)
(/usr/local/texlive/2015/texmf-dist/tex/latex/pdftex-def/pdftex.def
(/usr/local/texlive/2015/texmf-dist/tex/generic/oberdiek/infwarerr.sty)
(/usr/local/texlive/2015/texmf-dist/tex/generic/oberdiek/ltxcmds.sty)))
(/usr/local/texlive/2015/texmf-dist/tex/latex/float/float.sty)
(./Assignment1.aux)
(/usr/local/texlive/2015/texmf-dist/tex/context/base/supp-pdf.mkii
[Loading MPS to PDF converter (version 2006.09.02).]
) (/usr/local/texlive/2015/texmf-dist/tex/generic/oberdiek/pdftexcmds.sty
(/usr/local/texlive/2015/texmf-dist/tex/generic/oberdiek/ifluatex.sty)
(/usr/local/texlive/2015/texmf-dist/tex/generic/oberdiek/ifpdf.sty))
(/usr/local/texlive/2015/texmf-dist/tex/latex/oberdiek/epstopdf-base.sty
(/usr/local/texlive/2015/texmf-dist/tex/latex/oberdiek/grfext.sty
(/usr/local/texlive/2015/texmf-dist/tex/generic/oberdiek/kvdefinekeys.sty))
(/usr/local/texlive/2015/texmf-dist/tex/latex/oberdiek/kvoptions.sty
(/usr/local/texlive/2015/texmf-dist/tex/generic/oberdiek/kvsetkeys.sty
(/usr/local/texlive/2015/texmf-dist/tex/generic/oberdiek/etexcmds.sty)))
(/usr/local/texlive/2015/texmf-dist/tex/latex/latexconfig/epstopdf-sys.cfg))
<alimg1.png, id=1, 462.528pt x 346.896pt> <use alimg1.png>
<alimg2.png, id=3, 462.528pt x 346.896pt> <use alimg2.png>
<alimg3.png, id=4, 462.528pt x 346.896pt> <use alimg3.png> [1{/usr/local/texlive/2015/texmf-var/fonts/map/pdftex/updmap/pdftex.map} <./alimg1.png>] [2 <./alimg2.png>] [3 <./alimg3.png>] (./Assignment1.aux) </usr/local/texlive/2015/texmf-dist/fonts/type1/public/amsfonts/cm/cmbx12.pfb></usr/local/texlive/2015/texmf-dist/fonts/type1/public/amsfonts/cm/cmmi10.pfb></usr/local/texlive/2015/texmf-dist/fonts/type1/public/amsfonts/cm/cmmi5.pfb></usr/local/texlive/2015/texmf-dist/fonts/type1/public/amsfonts/cm/cmmi7.pfb></usr/local/texlive/2015/texmf-dist/fonts/type1/public/amsfonts/cm/cmr10.pfb></usr/local/texlive/2015/texmf-dist/fonts/type1/public/amsfonts/cm/cmr7.pfb>
Output written on Assignment1.pdf (3 pages, 466001 bytes).
Transcript written on Assignment1.log.

```

## 1.2 Source code

```

import numpy as np
import matplotlib.pyplot as plt
from math import cos, pi
if __name__ == '__main__':
    import sys

def get_seqs(fx, fy, ax, ay, phi, dt, n):

```

```

seqs = [[], [], []]
for i in range(n+1):
    t = dt * i
    x = ax * cos(2*pi*fx*t)
    y = ay * sin(2*pi*fy*t + phi)
    z = x + y
    seqs[0].append(str(x))
    seqs[1].append(str(y))
    seqs[2].append(str(z))
with open("seq_output.txt", "w") as f:
    for seq in seqs:
        f.write(", ".join(seq)+"\n")
f.close()

def get_seqs_np(fx, fy, ax, ay, phi, dt, n):
    times = np.linspace(0, n*dt, n+1)
    x = ax * np.cos(2*np.pi*fx*times)
    y = ay * np.sin(2*np.pi*fy*times + phi)
    z = x + y
    with open("seq_output2.txt", "w") as f:
        for item in [x, y, z]:
            item = item.astype('str').tolist()
            f.write(", ".join(item)+"\n")
    f.close()

def plot_seqs(fx=0, fy=0, ax=0, ay=0, phi=0, dt=0, n=0, plotz=0):
    get_seqs_np(fx, fy, ax, ay, phi, dt, n)
    seqs = []
    with open("seq_output2.txt", "r") as f:
        for line in f:
            line = line.strip('\n')
            line = line.split(',')
            for i in range(len(line)):
                line[i] = float(line[i])
            seqs.append(line)
    f.close()
    if plotz == 1:
        times = np.linspace(0, n*dt, n+1)
        z = seqs[2]
        plt.plot(times, z)
    else:
        x = seqs[0]
        y = seqs[1]
        plt.plot(x, y)
    plt.savefig("a1img"+name+".png", dpi=500)

```

```

fx, fy, ax, ay, phi, dt, n, plotz, name = sys.argv[1:]
fx, fy, ax, ay, phi, dt, n, plotz = float(fx), float(fy), float(ax), \
    float(ay), float(phi), float(dt), float(n), int(plotz)
plot_seqs(fx, fy, ax, ay, phi, dt, n, plotz)

```

### 1.3 makefile

```

TEX = pdflatex -shell-escape -interaction=nonstopmode -file-line-error
Script = Assignment1copy.py
a1img1 = 1 1 1 1 0 0.01 100 1 1
a1img2 = 1 1 1 1 20 0.01 100 1 2
a1img3 = 1 1 1 1 20 0.01 100 0 3

all: Assignment1.pdf

view:
open Assignment1.pdf

clean:
rm -f Assignment1.pdf a1img1.png a1img2.png a1img3.png

%.png: $(Script)
python $^ $(*)

Assignment1.pdf: a1img1.png a1img2.png a1img3.png
$(TEX) Assignment1.tex

```

## 2 Lissajous Figures

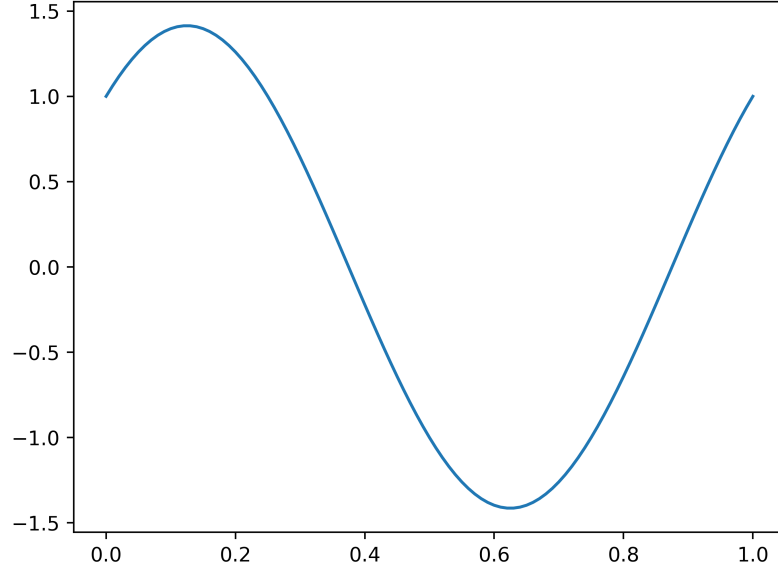


Figure 1: Lissajous figures for integer frequency ratios. Across rows and then down columns, the x:y frequency ratios are 1:1, 1:2, 1:3, and 1:4 respectively. The ratio  $\frac{f_y}{f_x}$  gives the number of peaks (or equivalently the number of troughs) on the graph for one oscillation in X (i.e. one "peak" on the right side and one "peak" on the left). The figures shown here correspond to the parameters  $A_x = A_y = 1$ ,  $\Phi = \frac{\pi}{4}$ ,  $\Delta t = 0.001$ , and  $N = 1000$ .

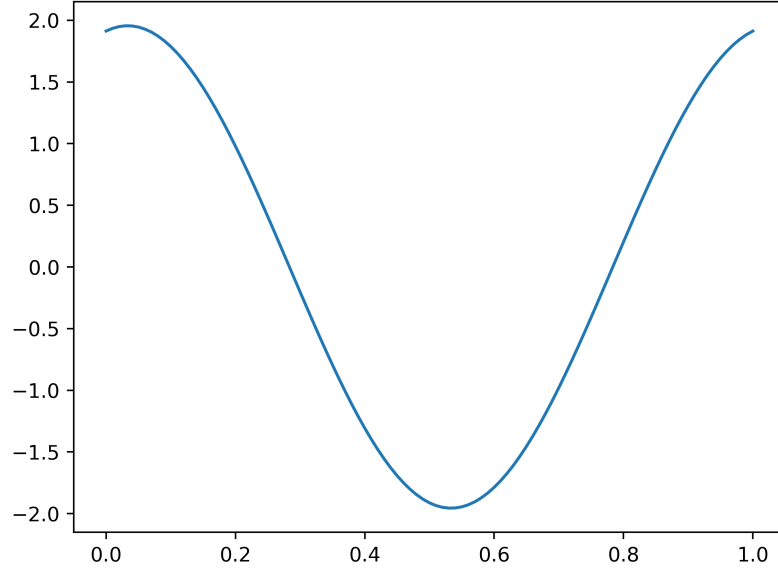


Figure 2: Lissajous figures for integer frequency ratios. Across rows and then down columns, the x:y frequency ratios are 1:1, 1:2, 1:3, and 1:4 respectively. The ratio  $\frac{f_y}{f_x}$  gives the number of peaks (or equivalently the number of troughs) on the graph for one oscillation in X (i.e. one "peak" on the right side and one "peak" on the left). The figures shown here correspond to the parameters  $A_x = A_y = 1$ ,  $\Phi = \frac{\pi}{4}$ ,  $\Delta t = 0.001$ , and  $N = 1000$ .

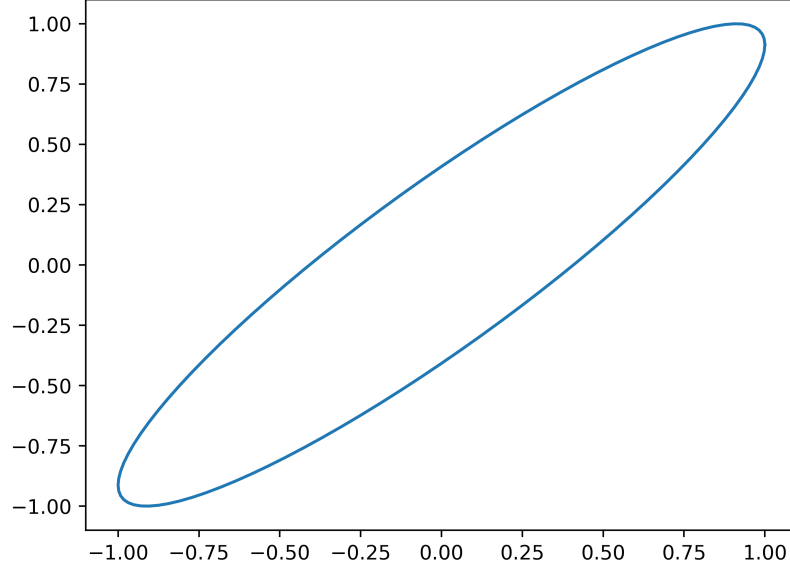


Figure 3: Lissajous figures for integer frequency ratios. Across rows and then down columns, the x:y frequency ratios are 1:1, 1:2, 1:3, and 1:4 respectively. The ratio  $\frac{f_y}{f_x}$  gives the number of peaks (or equivalently the number of troughs) on the graph for one oscillation in X (i.e. one "peak" on the right side and one "peak" on the left). The figures shown here correspond to the parameters  $A_x = A_y = 1$ ,  $\Phi = \frac{\pi}{4}$ ,  $\Delta t = 0.001$ , and  $N = 1000$ .