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1: #!/usr/bin/python
2: import numpy as np
3: import pylab
4:
5: def dft(y):
6:     N = len(y)
7:     c = np.zeros(N//2+1, complex)
8:     for k in range(N//2+1):
9:         for n in range(N):
10:             c[k] += y[n] * np.exp(-2j*np.pi*k*n/N)
11:     return c
12:
13: def part_a():
14:     data = np.loadtxt('sunspots.txt')
15:     print("approx: {}".format(133.2))
16:     pylab.plot(data[:,0], data[:,1])
17:     pylab.show()
18:
19: def part_b():
20:     data = np.loadtxt('sunspots.txt')
21:     coef = np.fft.rfft(data[:,1])
22:     pylab.plot(np.power(np.abs(coef), 2))
23:     pylab.show()
24:
25: def part_c():
26:     data = np.loadtxt('sunspots.txt')
27:     coef = list(np.fft.rfft(data[:,1]))
28:     disp = [np.abs(x)**2 for x in coef]
29:     peak = disp.index(max(disp[2:]))
30:
31: def main():
32:     part_a()
33:     part_b()
34:     part_c()
35:
36: if __name__ == "__main__":
37:     main()
```