Final Project

```
from mpmath import *
def zetaEMS(s,N,v):
    sum = 0

    for j in range(1,N):
        sum = sum + j**(-s)

    sum = sum + N**(1-s)/(s-1) + N**(-s)/2

    sprod = s
    fact = 1
    Npower = N**(1-s)
    for k in range(1,v):
        b = bernoulli(2*k)
        fact = fact*(2*k-1)*2*k
        Npower = Npower/(N**2)
        sum = sum + b/fact*sprod*Npower
        sprod = sprod*(s+2*k-1)*(s+2*k)
    return sum
```

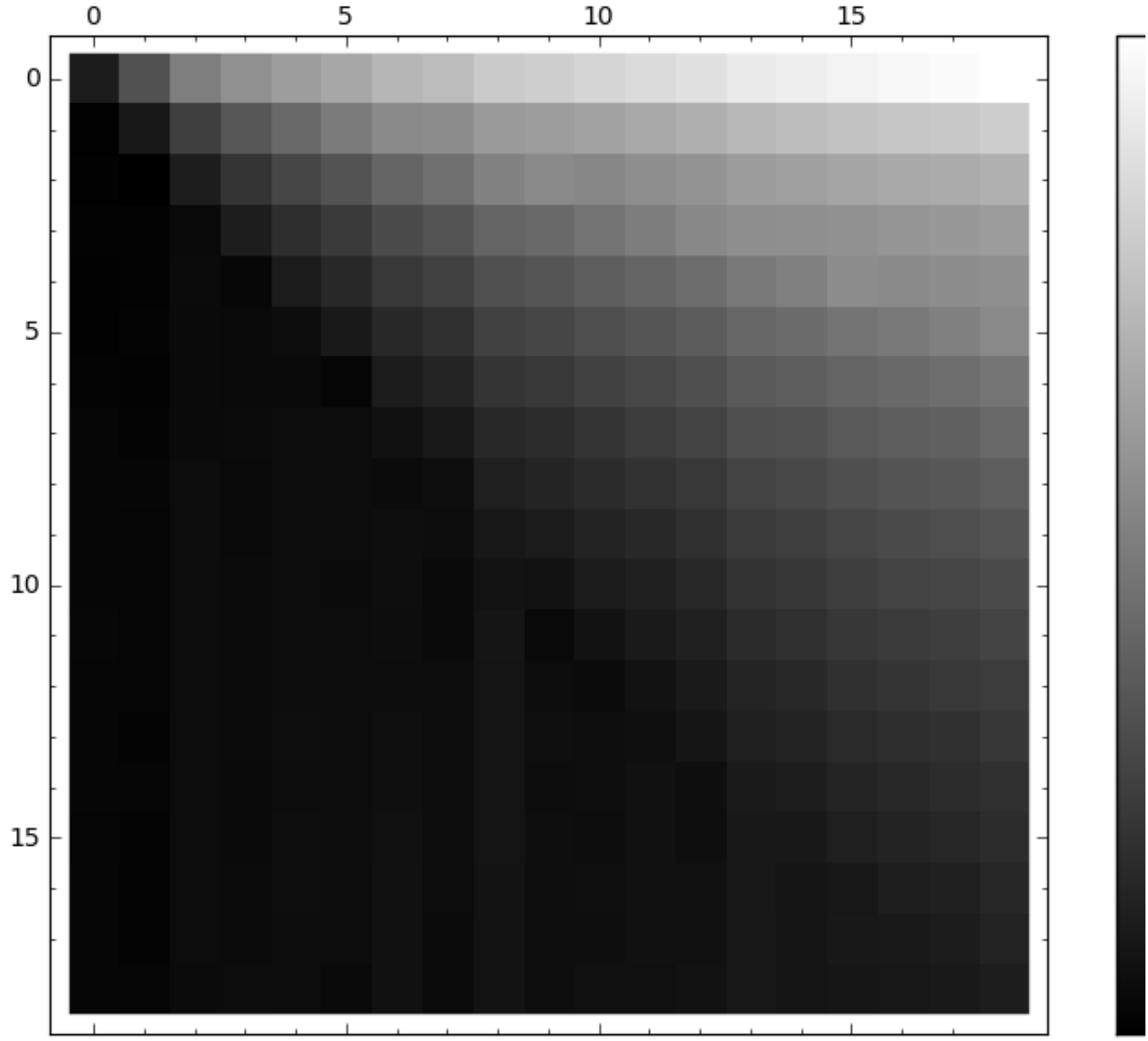
```
import time
t = time.time()
print zetaEMS(0.2+16000*I, 10000, 10000)
print time.time() - t
t = time.time()
print zeta(0.2+16000*I)
print time.time() - t
```

```
(7.5222303704218 + 2.10048923562801j)
8.20638203621
(7.52223037041665 + 2.10048923562972j)
0.183481931686
```

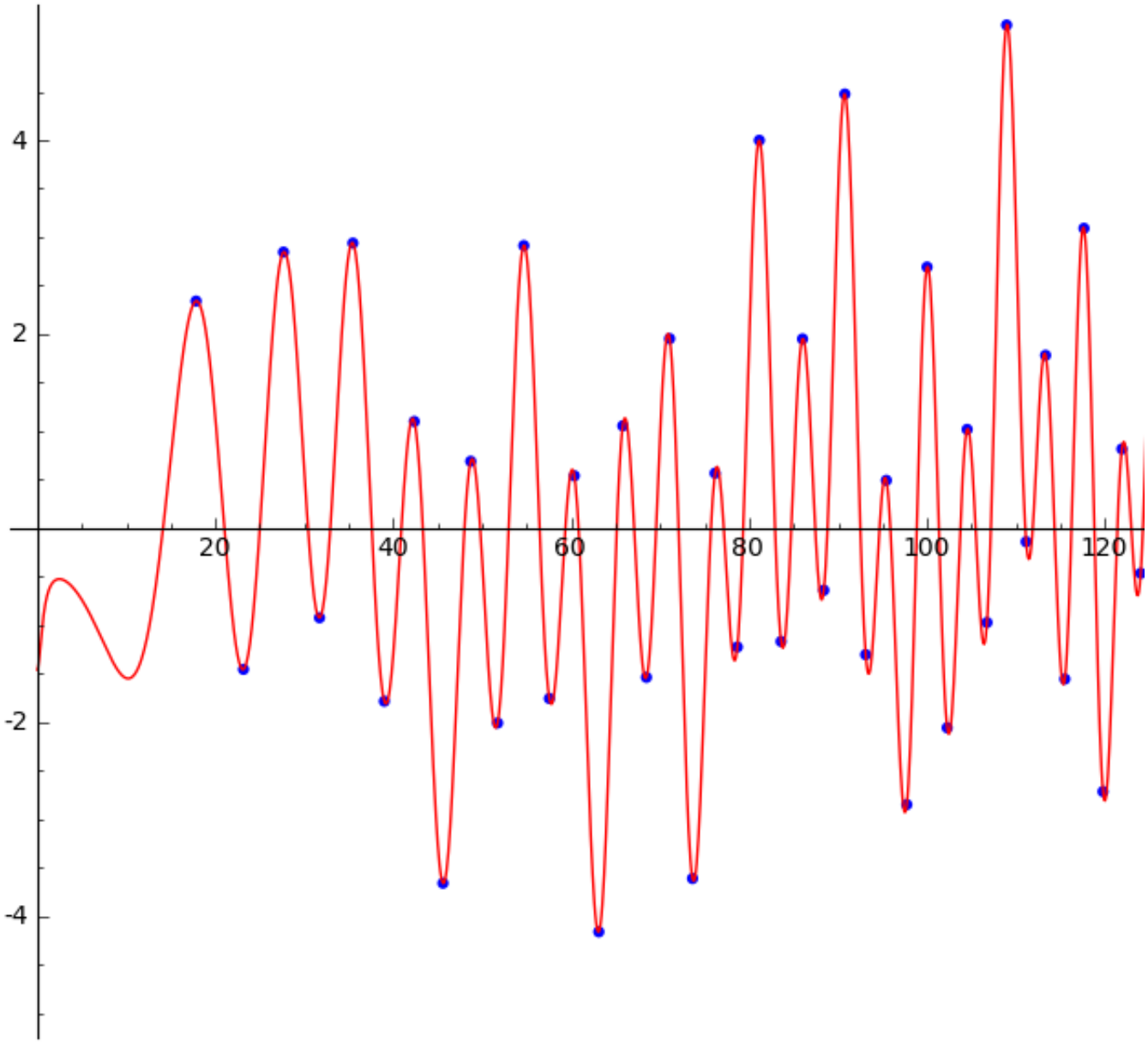
```
r = 0.3
T = range(100,2000, 100)
S = [r + I*t for t in T]
v = 10
N = range(50, 1000, 50)

p = []
for j in range(len(N)):
    err = [log(abs(zetaEMS(s,N[j],v) - zeta(s))/abs(zeta(s))) for
s in S]
    p.append(err)
```

```
matrix_plot(p, colorbar=True)
```




```
G = [grampoint(n) for n in range(50)]
ZG = [(g, siegelz(g)) for g in G]
L1 = list_plot(ZG, plotjoined=False, pointsize=20,
legend_label='$Z(g_n)$')
ZT = [(t/10,siegelz(t/10)) for t in range(1500)]
L2 = list_plot(ZT, plotjoined=True,color='red',
legend_label='$Z(t)$')
show(L2+L1)
```


4
2
-2
-4
20
40
60
80
100
120