Performance

Here is a simple sorting algorithm. Use %timeit to compute the largest array of uniform-[0,1] random floats that it can sort in 100ms, 1sec, 10sec. Report the same for the built in sorting algorithm. Include the commands you used.

Solution

Code:

```
def insertionsort(A):
for i in range(len(A)):
for j in range(i+1,len(A)):
if A[i] > A[j]:
(A[i], A[j]) = (A[j], A[i])


B = []
import random
for i in range(0,1000000):
B.append(random.random())

Bsorted = sorted(B)
insertionsort(B)
assert B == Bsorted

%timeit [insertionsort(B)]
%timeit [sorted(B)]


# 100 ms - Insertion Sort
insrt100 = []

for i in range(0,912):
insrt100.append(random.random())
%timeit [insertionsort(insrt100)]

# 1 s - Insertion Sort
insrt1 = []

for i in range(0,2750):
insrt1.append(random.random())

%timeit [insertionsort(insrt1)]

# 10 s - Insertion Sort
insrt10 = []
```

```
for i in range(0,8000):
insrt10.append(random.random())

%timeit [insertionsort(insrt10)]


# 100 ms - Built in Sort
srt100 = []

for i in range(0,77000):
srt100.append(random.random())
%timeit [sorted(srt100)]

# 1 s - Built in Sort
srt1 = []

for i in range(0,600000):
srt1.append(random.random())

%timeit [sorted(srt1)]

# 10 s - Built in Sort
srt10 = []

for i in range(0,4500000):
srt10.append(random.random())

%timeit [sorted(srt10)]
```

Output:

1000 loops, best of 3: 1.29 ms per loop

100000 loops, best of 3: 8.16 µs per loop

10 loops, best of 3: 98.5 ms per loop (100 ms – Insertion Sort)

1 loops, best of 3: 1.01 s per loop (1 s – Insertion Sort)

1 loops, best of 3: 8.79 s per loop (10 s – Insertion Sort)

10 loops, best of 3: 96.7 ms per loop (100 ms – Built in Sort)

1 loops, best of 3: 1.02 s per loop (1 s – Built in Sort)

1 loops, best of 3: 9.91 s per loop (10 s – Built in Sort)

Graphing

The Mandelbrot set is the set of complex numbers c for which the sequence (c, c^2 + c, (c^2 + c)^2 + c, ... does not diverge. (Here x^2 denotes the square of x.)

Use NumPy to compute the Mandelbrot set over real part in [-1.0, 2.0] and imaginary part in [-1.5, 1.5].

Divide the region into a 1000x1000 grid, and perform 1000 iterations of the iteration for each point. Take points whose magnitude is less than 1.0 to be part of the set.

Show both your program and the plot it generated inline with your writeup.

Page 97 of PDA should help you get started. Note that Python has a built-in complex type, which you can write for example as 1.4 + 3.1j.

Solution

Code:

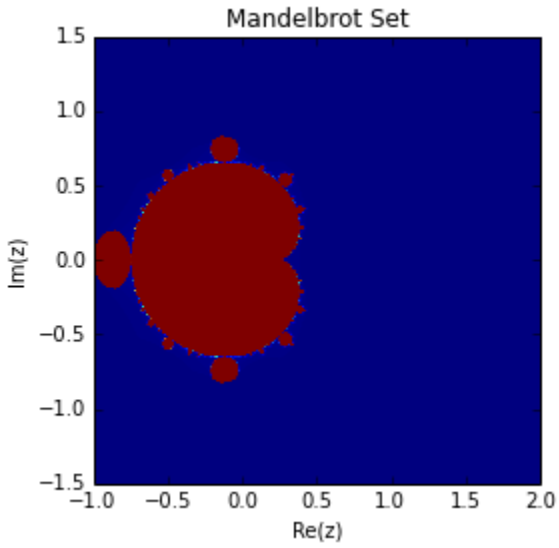
```
from numpy import *
from pylab import *
iterations = 1000

density = 1000
x_min, x_max = -1, 2
y_min, y_max = -1.5, 1.5
x, y = meshgrid(linspace(x_min, x_max, density),
linspace(y_min, y_max, density))

c = x + 1j*y
z = c.copy()
m = zeros((density, density))
for n in xrange(iterations):

print "Iteration No." , n
indices = (abs(z) <= 1)
z[indices] = z[indices]**2 + c[indices]
m[indices] = n
imshow(m,
extent=(x_min, x_max, y_min, y_max))
title('Mandelbrot Set')
xlabel('Re(z)')
ylabel('Im(z)')
show()
```

Output:



Pandas

Work through the MovieLens 1M DataSet example on pages 26-31. Specifically, through all the steps in that example, and also find the 10 movies that have the least disagreement among viewers, using the same metrics and methodology as in the example.

Turn in screenshots of the top 10 films among female viewers, the top 10 movies that were preferred by men which were not as highly rated by women, and the 10 movies with the least disagreement.

Solution

Top 10 films among female viewers:

```
In [63]: top_female_ratings[np.isfinite(top_female_ratings['M'])][:10]
Out[63]:
gender                                                F        M
title
Clean Slate (Coup de Torchon) (1981)                  5  3.857143
Ballad of Narayama, The (Narayama Bushiko) (1958)     5  3.428571
Raw Deal (1948)                                       5  3.307692
Skipped Parts (2000)                                  5  4.000000
Lamerica (1994)                                       5  4.666667
Gambler, The (A J@t@kos) (1997)                       5  3.166667
Brother, Can You Spare a Dime? (1975)                 5  3.642857
Ayn Rand: A Sense of Life (1997)                      5  4.000000
24 7: Twenty Four Seven (1997)                        5  3.750000
Twice Upon a Yesterday (1998)                         5  3.222222
```

The top 10 movies that were preferred by men which were not as highly rated by women:

```
In [83]: a=b[np.isfinite(b['diff'])][:10]

In [84]: a
Out[84]:
gender                                     F         M      diff
title
Tigrero: A Film That Was Never Made (1994)  1  4.333333  3.333333
Neon Bible, The (1995)                      1  4.000000  3.000000
Enfer, L' (1994)                            1  3.750000  2.750000
Stalingrad (1993)                           1  3.593750  2.593750
Killer: A Journal of Murder (1995)          1  3.428571  2.428571
In God's Hands (1998)                       1  3.333333  2.333333
Dangerous Ground (1997)                     1  3.333333  2.333333
Rosie (1998)                                1  3.333333  2.333333
Flying Saucer, The (1950)                   1  3.300000  2.300000
Jamaica Inn (1939)                          1  3.142857  2.142857
```

10 movies with the least disagreement:

```
In [87]: rating_std_by_title.order(ascending=True)[:10]
Out[87]:
title
End of the Affair, The (1955)          0
Get Over It (1996)                     0
Gate of Heavenly Peace, The (1995)     0
Naked Man, The (1998)                  0
Illtown (1996)                         0
Napoleon and Samantha (1972)           0
Moonlight Murder (1936)                0
Yankee Zulu (1994)                     0
Johnny 100 Pesos (1993)                0
Santa with Muscles (1996)              0
Name: rating, dtype: float64
```