alg_test

May 6, 2019

```
In [1]: from sort import Sort
        from insert_sort import InsertSort
        from merge_sort import MergeSort
        from quick_sort import QuickSort
```

```
In [2]: import numpy as np
        import matplotlib.pyplot as plt
        %matplotlib inline
```

```
In [3]: import random
        import sys
```

0.1 Generate Data and Sort

```
In [24]: isort = InsertSort([])
         msort = MergeSort([])
         qsort = QuickSort([])

         i_runtime = []
         m_runtime = []
         q_runtime = []

         i_jmptime = []
         m_jmptime = []
         q_jmptime = []

         i_cmprtime = []
         m_cmprtime = []
         q_cmprtime = []
```

```
In [25]: for i in range(1, 10):
             isort.list = np.random.randint(i*1000, size = i*1000)
             msort.list = np.random.randint(i*1000, size = i*1000)
             qsort.list = np.random.randint(i*1000, size = i*1000)

             isort.time(isort.insert_sort)
             msort.time(msort.merge_sort)
             qsort.time(qsort.quick_sort)
```

```
        i_runtime.append(isort.run_time)
        m_runtime.append(msort.run_time)
        q_runtime.append(qsort.run_time)

        i_jmptime.append(isort.jump_time)
        m_jmptime.append(msort.jump_time)
        q_jmptime.append(qsort.jump_time)

        i_cmprtime.append(isort.compare_time)
        m_cmprtime.append(msort.compare_time)
        q_cmprtime.append(qsort.compare_time)
```

```
In [35]: i_runtime
```

```
Out[35]: [0.2829897403717041,
          0.7152543067932129,
          2.428441047668457,
          4.439424991607666,
          5.833850145339966,
          7.515944719314575,
          9.685591220855713,
          12.877131462097168,
          16.592695236206055]
```

0.2 Plot Running Time

```
In [36]: # plot running time

         r = range(9)
         plt.plot(r, i_runtime, c="r", label="insert_sort")
         plt.plot(r, m_runtime, c="b",  label="merge_sort")
         plt.plot(r, q_runtime, c="g",  label="quick_sort")

         plt.legend()
         plt.xlabel("NUMBER/k")
         plt.ylabel("TIME")
         plt.show()
```

```
In [37]: plt.plot(r, m_runtime, c="b",  label="merge_sort")
         plt.plot(r, q_runtime, c="g",  label="quick_sort")

         plt.legend()
         plt.xlabel("NUMBER/k")
```

```
        plt.ylabel("TIME")
        plt.show()
```

0.3 Plot Jump Time

```
In [38]: i_jmptime
```

```
Out[38]: [237065,
          981540,
          2253463,
          3965972,
          6252352,
          8935439,
          12215806,
          15985018,
          20017236]
```

```
In [39]: r = range(9)
         plt.plot(r, i_jmptime, c="r", label="insert_sort")
         plt.plot(r, m_jmptime, c="b",  label="merge_sort")
         plt.plot(r, q_jmptime, c="g",  label="quick_sort")

         plt.legend()
         plt.xlabel("NUMBER/k")
         plt.ylabel("TIME")
         plt.show()
```

```
In [40]: plt.plot(r, m_jmptime, c="b",  label="merge_sort")
         plt.plot(r, q_jmptime, c="g",  label="quick_sort")

         plt.legend()
         plt.xlabel("NUMBER/k")
         plt.ylabel("TIME")
         plt.show()
```

0.4 Plot Compare Time

```
In [43]: r = range(9)
         plt.plot(r, i_cmprtime, c="r", label="insert_sort")
         plt.plot(r, m_cmprtime, c="b",  label="merge_sort")
         plt.plot(r, q_cmprtime, c="g",  label="quick_sort")

         plt.legend()
         plt.xlabel("NUMBER/k")
         plt.ylabel("TIME")
         plt.show()
```

```
In [44]: plt.plot(r, m_cmprtime, c="b",  label="merge_sort")
         plt.plot(r, q_cmprtime, c="g",  label="quick_sort")

         plt.legend()
         plt.xlabel("NUMBER/k")
         plt.ylabel("TIME")
         plt.show()
```

0.5 Worst Condition

```
In [54]: ascend = range(1000)
         descend = [x for x in ascend[::-1]]
```

```
In [64]: iw_runtime = []
         mw_runtime = []
         qw_runtime = []

         iw_jmptime = []
         mw_jmptime = []
         qw_jmptime = []

         iw_cmprtime = []
         mw_cmprtime = []
         qw_cmprtime = []
```

0.5.1 ascend order

```
In [65]: sys.setrecursionlimit(3000)

         isort.list = [x for x in ascend[:]]
         msort.list = [x for x in ascend[:]]
         qsort.list = [x for x in ascend[:]]

         isort.time(isort.insert_sort)
         msort.time(msort.merge_sort)
         qsort.time(qsort.quick_sort)

         iw_runtime.append(isort.run_time)
         mw_runtime.append(msort.run_time)
         qw_runtime.append(qsort.run_time)

         iw_jmptime.append(isort.jump_time)
         mw_jmptime.append(msort.jump_time)
         qw_jmptime.append(qsort.jump_time)

         iw_cmprtime.append(isort.compare_time)
         mw_cmprtime.append(msort.compare_time)
         qw_cmprtime.append(qsort.compare_time)
```

0.5.2 descend order

```
In [66]: sys.setrecursionlimit(3000)

         isort.list = [x for x in ascend[::-1]]
         msort.list = [x for x in ascend[::-1]]
         qsort.list = [x for x in ascend[::-1]]

         isort.time(isort.insert_sort)
         msort.time(msort.merge_sort)
         qsort.time(qsort.quick_sort)

         iw_runtime.append(isort.run_time)
         mw_runtime.append(msort.run_time)
         qw_runtime.append(qsort.run_time)

         iw_jmptime.append(isort.jump_time)
         mw_jmptime.append(msort.jump_time)
         qw_jmptime.append(qsort.jump_time)

         iw_cmprtime.append(isort.compare_time)
         mw_cmprtime.append(msort.compare_time)
         qw_cmprtime.append(qsort.compare_time)
```

0.5.3 random order

```
In [67]: iw_runtime.append(i_runtime[0])
         mw_runtime.append(m_runtime[0])
         qw_runtime.append(q_runtime[0])

         iw_jmptime.append(i_jmptime[0])
         mw_jmptime.append(m_jmptime[0])
         qw_jmptime.append(q_jmptime[0])

         iw_cmprtime.append(i_cmprtime[0])
         mw_cmprtime.append(m_cmprtime[0])
         qw_cmprtime.append(q_cmprtime[0])
```

```
In [68]: iw_runtime
```

```
Out[68]: [0.00020813941955566406, 0.26102375984191895, 0.2829897403717041]
```

0.6 Plot runtime

```
In [70]: label_list = ["ascend", "descend", "random"]
         color = ["red", "green", "blue"]
         explode = [0.01, 0.01, 0.01]

         plt.pie(iw_runtime, explode = explode, colors = color, labels = label_list)
         plt.legend()
         plt.show()
```

```
In [76]: label_list = ["ascend", "descend", "random"]
         color = ["red", "green", "blue"]
         explode = [0.01, 0.01, 0.01]

         plt.pie(mw_runtime, explode = explode, colors = color, labels = label_list)
         plt.legend()
         plt.show()
```

```
In [75]: label_list = ["ascend", "descend", "random"]
         color = ["red", "green", "blue"]
         explode = [0.01, 0.01, 0.01]
         plt.pie(qw_runtime, explode = explode, colors = color, labels = label_list)
         plt.legend()
         plt.show()
```

0.7 plot jump time

```
In [77]: label_list = ["ascend", "descend", "random"]
         color = ["red", "green", "blue"]
         explode = [0.01, 0.01, 0.01]

         plt.pie(iw_jmptime, explode = explode, colors = color, labels = label_list)
         plt.legend()
         plt.show()
```

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```
In [78]: label_list = ["ascend", "descend", "random"]
         color = ["red", "green", "blue"]
         explode = [0.01, 0.01, 0.01]

         plt.pie(mw_jmptime, explode = explode, colors = color, labels = label_list)
         plt.legend()
         plt.show()
```

```
In [79]: label_list = ["ascend", "descend", "random"]
         color = ["red", "green", "blue"]
         explode = [0.01, 0.01, 0.01]

         plt.pie(qw_jmptime, explode = explode, colors = color, labels = label_list)
         plt.legend()
         plt.show()
```

0.8 plot compare time

```
In [80]: label_list = ["ascend", "descend", "random"]
         color = ["red", "green", "blue"]
         explode = [0.01, 0.01, 0.01]

         plt.pie(iw_cmprtime, explode = explode, colors = color, labels = label_list)
         plt.legend()
         plt.show()
```

```
In [81]: label_list = ["ascend", "descend", "random"]
         color = ["red", "green", "blue"]
         explode = [0.01, 0.01, 0.01]

         plt.pie(mw_cmprtime, explode = explode, colors = color, labels = label_list)
         plt.legend()
         plt.show()
```

```
In [82]: label_list = ["ascend", "descend", "random"]
         color = ["red", "green", "blue"]
         explode = [0.01, 0.01, 0.01]

         plt.pie(qw_cmprtime, explode = explode, colors = color, labels = label_list)
         plt.legend()
         plt.show()
```