2022-1 컴퓨팅 사고와 파이썬 프로그래밍 기말고사 Exam2D

Exam2D. 실수자료형 (float) 리스트에 대한 병합정렬과 퀵정렬 성능 비교
(40점, 시험 시간 45분 (11:15 ~ 12:00))

(1) 요구사항

- 난수의 개수 (N)이 주어질 때, -N/200 ~ +(N-1)/200 범위의 중복되지 않는 실수자료형 (float) 난수 리스트를 생성하여 반환하는 함수 genRandFloatList(N)를 사용자 정의 모듈 MyList.py에 구현하라.
- 실수자료형 리스트의 첫 부분과 끝 부분의 리스트 원소를 한 줄 당 per_line 원소 x sample_lines 줄 출력하는 함수 printFloatListSample(L, per_line, sample_lines)를 MyList.py에 구현하라. float 자료형인 리스트 원소는 소숫점 이하 2자리 까지 출력할 것.
- 주어진 float 자료형 리스트를 오름차순으로 병합 정렬하는 함수 mergeSort(L)을 사용자 정의 모듈 MySorting.py에 구현하라.
- 주어진 float 자료형 리스트를 오름차순으로 퀵정렬하는 함수 quickSort(L)을 사용자 정의 모듈 MySorting.py에 구현하라.
- 실수자료형 난수 리스트의 크기 (L_size)를 입력받고, 중복되지 않는 난수 리스트를 생성한 후, 병합정렬과 퀵정렬을 수행하며, 성능을 비교하는 main() 함수를 작성하라.
- main() 함수에서는 난수 리스트의 크기 (L_size)를 입력받고, genRandFloatList() 함수를 사용하여 중복되지 않는 난수 리스트를 생성한 후, printFloatListSampe() 함수를 사용하여 출력하며, mergeSort() 함수를 사용하여 정렬한 후, 정렬된 리스트를 출력한다.
- main() 함수에는 정렬된 리스트를 random모듈의 shuffle() 함수를 사용하여 뒤섞은 후, 출력하고, quickSort() 함수를 사용하여 오름차순으로 정렬한 후, 출력한다.
- mergeSort()와 quickSort()를 수행할 때 걸린 경과시간을 측정하여 초 단위로 출력하라.
- 프로그램 출력 첫 부분에 "2022-1 컴사파 Exam2D 학번: 00000000, 성명: 홍길동" 양식으로 본인 학번과 이름을 출력할 것.

(2) main() 함수 예시

```python
# Exam2d - Performance Comparisons of Sorting Algorithms (quickSort, mergeSort)

. . . . # 필요한 모듈 import

def main():
    . . . . # 2022-1 컴사파 Exam2D 학번: 00000000, 성명: 홍길동 출력
    L = [100000, 500000, 1000000, 5000000]
    for L_size in L:
        print("\nGenerating random list of size ({}) ...".format(L_size))
        L = MyList.genRandFloatList(L_size)

        # testing MergeSorting
        print("Before mergeSort of L :")
        MyList.printFloatListSample(L, 10, 3)
        t1 = time.time()
        L = MySortings.mergeSort(L)
        t2 = time.time()
        print("\nAfter mergeSort of L :")
        MyList.printFloatListSample(L, 10, 3)
        time_elapsed = t2 - t1
        print("Merge sorting of list (size={}) took {} sec".format(L_size, time_elapsed))

        # testing Quick Sorting
        random.shuffle(L)
        print("Before quickSort of L :")
        MyList.printFloatListSample(L, 10, 3)
        t1 = time.time()
        MySortings.quickSort(L)
        t2 = time.time()
        print("After quickSort of L :")
        MyList.printFloatListSample(L, 10, 3)
        time_elapsed = t2 - t1
        print("Quick sorting of list (size={}) took {} sec".format(L_size, time_elapsed))
if __name__ == "__main__":
    main()
```

(3) shell 입출력 예시

```
2022-1 컴사과 기말고사 학번: 0000, 이름: 홍길동
Generating random list of size (100000) ...
Before mergeSort of L :
   173.74    -36.61   -203.82    221.48     86.78    -23.76    471.33    148.47    330.72   -440.90
   339.66    -78.35     42.90    386.59   -467.63   -413.48   -343.66    329.73     57.05    -38.90
    46.88    170.32     15.86    426.36    378.96    320.77    483.73    419.50    307.74   -261.62
   . . . . . .
   275.81   -152.00    381.92     38.38   -391.04   -249.12   -457.98   -284.62   -393.87   -149.85
  -430.15    163.85   -105.61     10.17   -233.17    195.43    -56.40    418.69    388.85   -307.11
    17.33    -91.55    400.41    492.66    301.07    437.89   -496.05     27.72    257.90    305.11

After mergeSort of L :
  -500.00   -499.99   -499.98   -499.97   -499.96   -499.95   -499.94   -499.93   -499.92   -499.91
  -499.90   -499.89   -499.88   -499.87   -499.86   -499.85   -499.84   -499.83   -499.82   -499.81
  -499.80   -499.79   -499.78   -499.77   -499.76   -499.75   -499.74   -499.73   -499.72   -499.71
   . . . . . .
   499.70    499.71    499.72    499.73    499.74    499.75    499.76    499.77    499.78    499.79
   499.80    499.81    499.82    499.83    499.84    499.85    499.86    499.87    499.88    499.89
   499.90    499.91    499.92    499.93    499.94    499.95    499.96    499.97    499.98    499.99
Merge sorting of list (size=100000) took 0.23109698295593262 sec
Before quickSort of L :
  -138.68   -248.41    -30.56    432.42    -69.34   -130.83    188.41   -325.44     34.57   -236.06
    45.80     48.63   -160.47   -343.47   -361.35   -314.47    -66.79    -52.58    480.70   -135.04
   316.37   -487.39    230.46   -439.70   -399.85    -63.52    -63.10   -199.91     41.71    423.75
   . . . . . .
  -489.99    305.80   -379.48   -245.44    303.34    217.95      7.44   -154.87    -26.96    488.39
    87.89    -54.61   -319.85     89.73   -119.22   -311.85    294.32   -447.31   -420.16   -481.14
  -365.44    177.57     42.99   -225.27     94.29   -456.70    334.78    -91.57   -365.30   -179.90
After quickSort of L :
  -500.00   -499.99   -499.98   -499.97   -499.96   -499.95   -499.94   -499.93   -499.92   -499.91
  -499.90   -499.89   -499.88   -499.87   -499.86   -499.85   -499.84   -499.83   -499.82   -499.81
  -499.80   -499.79   -499.78   -499.77   -499.76   -499.75   -499.74   -499.73   -499.72   -499.71
   . . . . . .
   499.70    499.71    499.72    499.73    499.74    499.75    499.76    499.77    499.78    499.79
   499.80    499.81    499.82    499.83    499.84    499.85    499.86    499.87    499.88    499.89
   499.90    499.91    499.92    499.93    499.94    499.95    499.96    499.97    499.98    499.99
Quick sorting of list (size=100000) took 0.1825423240661621 sec

Generating random list of size (1000000) ...
Before mergeSort of L :
   149.96   -995.22   4030.43     59.90   2908.36   2307.83   2726.87   -301.17  -4093.81   1607.99
  1881.90   4553.06   3267.11    879.30  -4663.93  -3500.58   3290.62   -301.15   1362.07  -4520.56
  3594.92  -2304.46   4791.26   3006.04   4171.23  -4071.58  -2620.43   -777.72   -669.34  -2990.44
   . . . . . .
  4477.35   1154.37   3034.99  -2175.56   4691.34  -4357.66  -3105.65  -1316.14  -3002.88   1209.61
  1385.92  -2121.61   2291.60   2949.63  -3630.15  -2560.20   4693.66    934.59  -3751.31  -4026.02
  2365.17    189.53  -1818.04  -4736.69    205.92   4625.04  -2942.40   -645.19   4795.92  -3399.73

After mergeSort of L :
 -5000.00  -4999.99  -4999.98  -4999.97  -4999.96  -4999.95  -4999.94  -4999.93  -4999.92  -4999.91
 -4999.90  -4999.89  -4999.88  -4999.87  -4999.86  -4999.85  -4999.84  -4999.83  -4999.82  -4999.81
 -4999.80  -4999.79  -4999.78  -4999.77  -4999.76  -4999.75  -4999.74  -4999.73  -4999.72  -4999.71
   . . . . . .
  4999.70   4999.71   4999.72   4999.73   4999.74   4999.75   4999.76   4999.77   4999.78   4999.79
  4999.80   4999.81   4999.82   4999.83   4999.84   4999.85   4999.86   4999.87   4999.88   4999.89
  4999.90   4999.91   4999.92   4999.93   4999.94   4999.95   4999.96   4999.97   4999.98   4999.99
Merge sorting of list (size=1000000) took 2.969179630279541 sec
Before quickSort of L :
  4513.95   3606.25   3833.44   4189.26  -1168.06    225.23  -2676.79   2733.16   3205.27  -1560.49
 -1290.23   -396.63   -205.04    787.42  -2247.62   3816.59  -4342.20   2603.55    544.66  -3840.97
 -4091.74  -2027.52   -865.23   1727.82  -1526.31   4212.81   3426.49   3760.72   3974.53   4747.64
   . . . . . .
 -2984.12  -2266.73   3622.30  -2090.31    682.42   4493.17   1916.56  -4686.31   2824.77   3304.68
  3518.40   4884.87  -2192.29  -2635.19   -303.41  -3891.37   3892.52  -1058.38   -974.24   3486.93
 -1838.24  -1264.64  -1604.48   2168.70   2882.50   2331.87   -584.56  -4704.71   3702.43   4700.62
After quickSort of L :
 -5000.00  -4999.99  -4999.98  -4999.97  -4999.96  -4999.95  -4999.94  -4999.93  -4999.92  -4999.91
 -4999.90  -4999.89  -4999.88  -4999.87  -4999.86  -4999.85  -4999.84  -4999.83  -4999.82  -4999.81
 -4999.80  -4999.79  -4999.78  -4999.77  -4999.76  -4999.75  -4999.74  -4999.73  -4999.72  -4999.71
   . . . . . .
  4999.70   4999.71   4999.72   4999.73   4999.74   4999.75   4999.76   4999.77   4999.78   4999.79
  4999.80   4999.81   4999.82   4999.83   4999.84   4999.85   4999.86   4999.87   4999.88   4999.89
  4999.90   4999.91   4999.92   4999.93   4999.94   4999.95   4999.96   4999.97   4999.98   4999.99
Quick sorting of list (size=1000000) took 2.321063280105591 sec

Generating random list of size (500000) ...
Before mergeSort of L :
  1461.40  -1845.23   1559.76  -1462.89  -1922.73  -2061.08   2190.68   -485.72   -147.18   1239.73
  1632.93   1301.93    997.26    -28.75    293.18  -1077.94   1768.14   -255.38  -2272.32    322.26
 -2355.00   1448.34    -47.92  -2194.31   -994.67   2012.45  -1926.99   1242.35   1557.95   1594.03
   . . . . . .
  -592.49   1263.05  -1863.60   -801.75   -589.64   1816.43  -1025.20  -2058.83   2368.60   1075.98
  -618.51   -574.88    441.55   -644.31  -1386.86     68.77  -2337.33     92.27    513.76   1960.90
   659.38   2222.36  -1339.84  -1658.99  -2129.64   1148.52    602.91  -2096.59   -708.36   1316.06

After mergeSort of L :
 -2500.00  -2499.99  -2499.98  -2499.97  -2499.96  -2499.95  -2499.94  -2499.93  -2499.92  -2499.91
 -2499.90  -2499.89  -2499.88  -2499.87  -2499.86  -2499.85  -2499.84  -2499.83  -2499.82  -2499.81
 -2499.80  -2499.79  -2499.78  -2499.77  -2499.76  -2499.75  -2499.74  -2499.73  -2499.72  -2499.71
   . . . . . .
  2499.70   2499.71   2499.72   2499.73   2499.74   2499.75   2499.76   2499.77   2499.78   2499.79
  2499.80   2499.81   2499.82   2499.83   2499.84   2499.85   2499.86   2499.87   2499.88   2499.89
  2499.90   2499.91   2499.92   2499.93   2499.94   2499.95   2499.96   2499.97   2499.98   2499.99
Merge sorting of list (size=500000) took 1.3669850826263428 sec
Before quickSort of L :
  1082.91  -1147.62   1614.77  -1452.32  -2017.14    911.76    971.16    508.47  -1232.19  -1283.17
 -1752.47   -839.60  -1337.66   -859.77   1509.12  -1048.82    617.55   -531.29  -1948.14   -223.10
 -2495.51  -2288.66   1032.27  -1323.58  -1511.80   -446.30   1193.48    983.80   1365.55  -1395.40
   . . . . . .
 -1476.23   -423.66  -2379.32  -2176.28    -14.60   2014.53   2326.22    708.14   1388.26  -1527.08
 -2156.43   -612.29  -1843.09  -1573.03    881.48   -894.65  -2441.77   -823.59  -1434.99    -70.54
  -899.42    518.70  -2028.78  -1045.80    -38.12  -1924.16   2120.50   -620.95   2332.78  -1539.80
After quickSort of L :
 -2500.00  -2499.99  -2499.98  -2499.97  -2499.96  -2499.95  -2499.94  -2499.93  -2499.92  -2499.91
 -2499.90  -2499.89  -2499.88  -2499.87  -2499.86  -2499.85  -2499.84  -2499.83  -2499.82  -2499.81
 -2499.80  -2499.79  -2499.78  -2499.77  -2499.76  -2499.75  -2499.74  -2499.73  -2499.72  -2499.71
   . . . . . .
  2499.70   2499.71   2499.72   2499.73   2499.74   2499.75   2499.76   2499.77   2499.78   2499.79
  2499.80   2499.81   2499.82   2499.83   2499.84   2499.85   2499.86   2499.87   2499.88   2499.89
  2499.90   2499.91   2499.92   2499.93   2499.94   2499.95   2499.96   2499.97   2499.98   2499.99
Quick sorting of list (size=500000) took 1.0552475452423096 sec

Generating random list of size (5000000) ...
Before mergeSort of L :
 -4473.18 -16561.35   5705.67   9486.40  14103.20 -15110.17   4390.39 -13034.50   -257.10   5888.44
 15343.51  -8108.38    791.13   5883.88  21182.39  11987.61 -13052.74  24622.38  16896.42  20911.83
-13681.95 -13903.19 -17079.95  -9032.97  -8341.01    929.07  10959.97  12240.92 -24277.22  15858.81
   . . . . . .
 -6470.71    366.24  20824.88 -21369.90 -24279.43  12985.53  20848.11  -5101.17  22450.14   5061.40
 20299.75 -13408.07    820.07   6723.95 -16830.26  14737.95  17996.13  -5047.38 -14489.89  17771.08
 -8355.77  22091.48   6231.78 -10889.19   8168.06  21735.15   1150.87  16598.05  15278.81  16354.31

After mergeSort of L :
-25000.00 -24999.99 -24999.98 -24999.97 -24999.96 -24999.95 -24999.94 -24999.93 -24999.92 -24999.91
-24999.90 -24999.89 -24999.88 -24999.87 -24999.86 -24999.85 -24999.84 -24999.83 -24999.82 -24999.81
-24999.80 -24999.79 -24999.78 -24999.77 -24999.76 -24999.75 -24999.74 -24999.73 -24999.72 -24999.71
   . . . . . .
 24999.70  24999.71  24999.72  24999.73  24999.74  24999.75  24999.76  24999.77  24999.78  24999.79
 24999.80  24999.81  24999.82  24999.83  24999.84  24999.85  24999.86  24999.87  24999.88  24999.89
 24999.90  24999.91  24999.92  24999.93  24999.94  24999.95  24999.96  24999.97  24999.98  24999.99
Merge sorting of list (size=5000000) took 17.932750701904297 sec
Before quickSort of L :
-19387.94 -14927.20  -9001.65 -14079.28  11427.80  10122.67  20129.59  20948.48  19547.51 -17548.10
-21649.35 -17359.89 -15114.39  18854.64  -4952.62   3198.00 -16145.95   1917.16  -8479.07 -20160.70
 19427.81  -9309.28  13353.40 -15844.51  18614.71  16229.87   2249.24 -24772.94  15849.39 -12176.55
   . . . . . .
-17771.30  19747.06 -18306.96     71.49   9535.58  -5013.51 -17672.60 -14210.32 -20801.91  23835.80
-22275.42 -19317.21    235.84  15586.40  14164.75 -14686.46   4038.09 -21196.88  -5948.42  15826.81
-21414.55   7212.38   6713.20 -19237.02  16896.13  -8751.17  19355.54 -20573.27  15495.77 -17280.15
After quickSort of L :
-25000.00 -24999.99 -24999.98 -24999.97 -24999.96 -24999.95 -24999.94 -24999.93 -24999.92 -24999.91
-24999.90 -24999.89 -24999.88 -24999.87 -24999.86 -24999.85 -24999.84 -24999.83 -24999.82 -24999.81
-24999.80 -24999.79 -24999.78 -24999.77 -24999.76 -24999.75 -24999.74 -24999.73 -24999.72 -24999.71
   . . . . . .
 24999.70  24999.71  24999.72  24999.73  24999.74  24999.75  24999.76  24999.77  24999.78  24999.79
 24999.80  24999.81  24999.82  24999.83  24999.84  24999.85  24999.86  24999.87  24999.88  24999.89
 24999.90  24999.91  24999.92  24999.93  24999.94  24999.95  24999.96  24999.97  24999.98  24999.99
Quick sorting of list (size=5000000) took 14.418692350387573 sec
```

(3) 결과물 제출

- 파이썬 소스코드 (Exam2D_학번_성명.py)
- 실행 결과 (capture된 이미지) (Exam2D실행결과_학번_성명.png)

(4) 본인 응시 및 사용 컴퓨터 IP 주소 확인을 위한 동영상 파일 2차 제출 !!