2022-1 (인)컴퓨팅사고와 파이썬 프로그래밍

기말고사 문제풀이



2022. 6. 11.

교수 김 영 탁 영남대학교 정보통신공학과

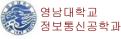
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Exam2A

◆ Exam2A. (40점, 시험 시간 (09:00 ~ 09:45) 45분)

(1) 요구사항

- Excel 파일 (Exam2A_student_scores.xlsx)에 학생 5명의 국어, 영어, 수학, 과학 성적을 표로 준비하라.
- 이 Excel 파일을 pandas의 read_excel() 함수를 사용하여 읽고, 데이터 프레임을 생성하라.
- 각 학생들의 성적 평균을 'Avg' 열 (column)을 추가하라.
- 데이터 프레임을 학생 성적 평균을 기준으로 내림차순으로 정렬하라.
- 데이터 프레임의 과목별 평균을 계산하여 "Per_class_Avg" 행 (row)를 추가하라.
- 종합정리된 데이터 프레임을 화면으로 출력하라.
- 종합정리된 데이터 프레임을 Excel file (Exam2A_processed_scores.xlsx)로 출력하라.
- 프로그램 출력 첫 부분에 "2022-1 컴사파 Exam2A 학번: 00000000, 성명: 홍길동" 양식으로 본인 학번과 이름을 출력할 것.

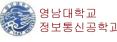


(2) 입력 데이터 파일 - Exam2A_scores.xlsx

4	Α	В	С	D	Е	F
1	st_id	st_name	Kor	Eng	Math	Sci
2	21234	Hong	95.7	92.3	95.2	75.9
3	22021	Kim	92.4	94.5	93.5	92.4
4	21203	Park	85.7	88.7	90.3	87.3
5	21057	Choi	98.9	97.2	98.2	95.3
6	22512	Lee	80.2	95.7	75.9	91.3

(3) main() 함수 - 예시

- # 기본 주석문
- # pandas 모듈 import
- # 핵심 기능 구현
- # 입력 데이터 파일로부터 데이터 입력 및 pandas 데이터 프레임 (df) 생성, 출력
- # 학생별 평균 성적 계산 및 avgs_per_student 데이터 프레임 생성
- # 데이터 프레임 df에 avgs_per_student를 'Avg' 레이블과 함께 추가
- # 데이터 프레임 df에서 각 과목별 평균성적 계산 및 avgs_per_class에 저장
- # 데이터 프레임 df를 Avg 열 기준의 내림차순으로 정렬하고, df_sorted 데이터 프레임에 대입
- # 데이터 프레임 df_sorted에 avgs_per_class을 마지막 행으로 추가
- # 마지막 행 (avgs_per_class)의 'st_name' 원소를 'Per_class_Avg'로 설정
- # 데이터 프레임 df_sorted를 Exam2A_processed_scores.xlsx에 저장

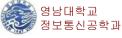


(4) 실행 결과 - 화면 출력 (예시) - df_with_avg, df_sorted_with_avg

```
df with avg =
   st_id st_name Kor Eng Math Sci
          Hong 95.7 92.3 95.2 75.9 89.775
1 22021
          Kim 92.4 94.5 93.5 92.4 93.200
2 21203
         Park 85.7 88.7 90.3 87.3 88.000
3 21057
        Choi 98.9 97.2 98.2 95.3 97.400
4 22512
         Lee 80.2 95.7 75.9 91.3 85.775
df sorted with avg =
     st id
               st_name Kor Eng Math Sci
3 21057.0
               Choi 98.90 97.20 98.20 95.30 97.400
1 22021.0
                 Kim 92.40 94.50 93.50 92.40 93.200
0 21234.0
                 Hong 95.70 92.30 95.20 75.90 89.775
                 Park 85.70 88.70 90.30 87.30 88.000
2 21203.0
4 22512.0
                 Lee 80.20 95.70 75.90 91.30 85.775
         Per_class_Avg 90.58 93.68 90.62 88.44 90.830
```

(5) 실행 결과 - Exam2A_processed_scores.xlsx

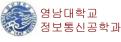
4	Α	В	С	D	E	F	G	Н
1		st_id	st_name	Kor	Eng	Math	Sci	Avg
2	3	21057	Choi	98.9	97.2	98.2	95.3	97.4
3	1	22021	Kim	92.4	94.5	93.5	92.4	93.2
4	0	21234	Hong	95.7	92.3	95.2	75.9	89.775
5	2	21203	Park	85.7	88.7	90.3	87.3	88
6	4	22512	Lee	80.2	95.7	75.9	91.3	85.775
7	5		Per_class_Avg	90.58	93.68	90.62	88.44	90.83



(6) 결과물 제출

- 파이썬 소스코드 : Exam2A_학번_성명.py
- Excel 입력 데이터 파일 : Exam2A_student_scores.xlsx
- Excel 출력 데이터 파일: Exam2A_processed_scores.xlsx
- 실행 결과 (capture된 이미지) (Exam2A실행결과_학번_성명.png)

(7) 본인 응시 및 사용 컴퓨터 IP 주소 확인을 위한 동영상 파일 제출!!



```
# Exam2A - pandas - df, calculation of average of each class, save to Excel
# <기본 주석문>
# Author:
# Date:
# Brief description:
import pandas as pd
df = pd.read excel("Exam2A student scores.xlsx")
print("df = \n", df)
df tmp = df.loc[:, ['Kor', 'Eng', 'Math', 'Sci']]
print("\ndf tmp = \n", df tmp)
avgs per student = df tmp.mean(1) # mean with axes 1
print("\navgs per student =\n", avgs per student)
df.loc[:, 'Avg'] = avgs_per_student
print("\ndf with avg =\n", df)
df tmp = df.loc[:, ['Kor', 'Eng', 'Math', 'Sci', 'Avg']]
avgs per class = df tmp.mean() # mean with axes 0
print("\navgs per class =\n", avgs per class)
df sorted = df.sort values(by='Avg', ascending=False)
df sorted.loc[len(df sorted), ['Kor', 'Eng', 'Math', 'Sci', 'Avg']]=avgs per class
df sorted.at[len(df sorted)-1, 'st id'] = ' '
df sorted.at[len(df sorted)-1, 'st name'] = 'Per class Avg'
print("\ndf sorted with avg =\n", df sorted)
print("Writing df to excel file")
with pd.ExcelWriter("Exam2A processed scores.xlsx") as excel writer:
  df sorted.to excel(excel writer, sheet name='Students Records')
```

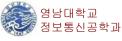
```
st id st name Kor Eng Math
0 21234
          Hong 95.7 92.3 95.2 75.9
           Kim 92.4 94.5 93.5 92.4
          Park 85.7 88.7 90.3 87.3
  21203
  21057
          Choi 98.9 97.2 98.2 95.3
  22512
           Lee 80.2 95.7 75.9 91.3
df tmp =
    Kor Eng Math Sci
0 95.7 92.3 95.2 75.9
1 92.4 94.5 93.5 92.4
3 98.9 97.2 98.2 95.3
4 80.2 95.7 75.9 91.3
avgs per student =
     89.775
    93,200
    88.000
    97,400
    85.775
dtype: float64
df_with_avg =
   st id st name Kor Eng Math Sci
          Hong 95.7 92.3 95.2 75.9 89.775
           Kim 92.4 94.5 93.5 92.4 93.200
          Park 85.7 88.7 90.3 87.3 88.000
          Choi 98.9 97.2 98.2 95.3 97.400
4 22512
           Lee 80.2 95.7 75.9 91.3 85.775
avgs_per_class =
        90.58
       93.68
       90.62
Sci
       88.44
       90.83
dtype: float64
df sorted with avg
     st_id
                 st_name
                                 Eng Math
3 21057.0
                  Choi 98.90 97.20 98.20 95.30 97.400
1 22021.0
                   Kim 92.40 94.50 93.50 92.40
0 21234.0
                  Hong 95.70 92.30 95.20 75.90 89.775
2 21203.0
                  Park 85.70 88.70 90.30 87.30
                   Lee 80.20 95.70 75.90 91.30 85.775
          Per_class_Avg 90.58 93.68 90.62 88.44 90.830
Writing df to excel file
```

Exam2B

◆ Exam2B. (35점, 시험 시간 (09:45 ~ 10:30) 45분)

(1) 요구사항

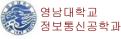
- 환율에 따라 미국 달러와 한국 원화를 계산하는 환전 계산기 구현을 위하여 class USD_KRW_Calculator()를 구현하라.
- class USD_KRW_Calculator()의 __init__() 함수에는 tkinter LabelFrame 생성 및 배치, tkinter GUI label 및 entry 생성 및 배치, 버튼 생성 및 배치 기능을 구현하라. LabelFrame의 title은 "USD_KRW Exchange Calculator"으로 설정하고, GROOVE 모양의 테두리를 사용하라.
- 이 환전 계산기에는 1 미국 달러에 대한 한국 원화 (Korean Won)의 환율을 입력하는 Entry, 미국 달러 금액을 입력/출력하는 Entry, 한국 원화 금액을 입력/출력 entry가 있으며, 각 항목에 대한 label이 표시된다.
- 각 금액의 출력은 오른쪽 맞춤으로 정렬할 것 (아래 GUI 입출력 예시 참조)
- 환율에 따른 미국 달러 -> 한국 원화 계산을 위하여 "US Dollar -> Kr Won" 녹색 버튼을 구현하고, 환율에 따른 한국 원화 -> 미국 달러 계산을 위하여 "Kr Won -> US Dollar" 노란색 버튼을 구현하라. 버튼은 아래 GUI 예시와 같이 한 줄에 배치하라.
- 환율, 미국 달러, 한국 원화의 입력/출력은 실수형 (float 또는 double)으로 표시하며, 소숫점 이하 2자리 까지 정리하여 출력하라.
- 생성된 tkinter GUI 윈도우 제목에 "2022-1 컴사파 Exam2B 학번: 00000000, 성명: 홍길동" 양식으로 본 인 학번과 이름을 출력할 것.



(2) GUI 입출력 (예시)





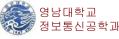


(3) main() 함수 (예시)

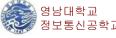
```
.... # 기본 주석문
....# 필요한 모듈 import
class USD_KRW_Calculator(master):
def __init__(self, master):
....# 이 부분은 직접 구현할 것
def convert_USD_KRW(self):
....# 이 부분은 직접 구현할 것
def convert_KRW_USD(self):
.... # 이 부분은 직접 구현할 것
def main():
  win = Tk()
  . . . . # win의 title로 2022-1 Exam2B 학번 이름 설정
  app = USD_KRW_Calculator(win)
  win.mainloop()
if name == " main ":
  main()
```

(4) 결과물 제출

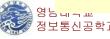
- 파이썬 소스코드 (Exam2B_학번_성명.py)
- 실행 결과 (capture된 이미지) (Exam2B실행결과_학번_성명.png)



```
# Exam2B tkinter GUI, Calc Student Scores (1)
# <기본 주석문>
# Author:
# Date:
# Brief description:
from math import *
from tkinter import *
class USD KRW Calculator():
  def init (self, master):
    frame = LabelFrame(master, text="USD_KRW Exchange Calculator", relief=GROOVE)
    frame.pack()
    self.USD KRW Ratio = DoubleVar()
    Label(frame, text = 'Exchange Ratio (1 USD => x KRW)').grid(row=0, column=0)
    Entry(frame, textvariable=self.USD_KRW_Ratio, justify=RIGHT).grid(row=0, column=1)
    self.us dollar var = DoubleVar()
    Label(frame, text='US Dollar').grid(row=1, column=0)
    Entry(frame, textvariable=self.us dollar var, justify=RIGHT).grid(row=1, column=1)
    self.kr won var = DoubleVar()
    Label(frame, text='Korean Won').grid(row=2, column=0)
    Entry(frame, textvariable=self.kr won var, justify=RIGHT).grid(row=2, column=1)
    button = Button(frame, text='US Dollar -> Kr Won', command=self.convert USD KRW, bg="green")
    button.grid(row=3, column=0)
    button = Button(frame, text='Kr Won -> US Dollar', command=self.convert KRW USD, bg="yellow")
    button.grid(row=3, column=1)
```



```
# Exam2B tkinter GUI, Calc Student Scores (2)
  def convert_USD_KRW(self):
     currency ratio = self.USD KRW Ratio.get()
     usd = self.us dollar var.get()
     krw = usd * currency ratio
    krw round = round(krw, 2)
     self.kr won var.set(krw round)
  def convert USD KRW(self):
     currency ratio = self.USD KRW Ratio.get()
     usd = self.us_dollar_var.get()
     krw = usd * currency ratio
     krw round = round(\overline{krw}, 2)
     self.kr won var.set(krw round)
  def convert KRW USD(self):
     currency ratio = self.USD KRW Ratio.get()
    krw = self.kr_won_var.get()
     usd = krw / currency ratio
     usd round = round(usd, 2)
     self.us dollar var.set( usd round)
def main():
  global window
  win = Tk()
  win.wm title('2022-1 컴사파 Exam2B 학번 이름')
  app = USD KRW Calculator(win)
  win.mainloop()
if __name__ == "__main__":
  main()
```



Exam₂C

- ◆ Exam2C. (35점, 시험 시간 (10:30 ~ 11:15) 45분)
 - (1) 요구사항
 - 다음 선형 방정식으로 구성된 선형시스템 A・X = B의 해 (a, b, c, d, e의 값으로 구성된 배열 X)를 NumPy 확장 모듈을 사용하여 구하는 파이썬 프로그램을 작성하라.

```
a + 5b + 3c + 3d + 7e = 105

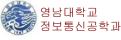
3a + 4b + 5c + 6d + 7e = 135

a + 3b + 5c + 7d + 9e = 145

3a + b + 4c + d + 5e = 74

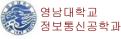
5a + 5b + 3c + 3d + e = 75
```

- Numpy 배열 A와 B을 구성하고, 각각 출력하라.
- 배열 A의 행렬식 (determinant) det_A를 구하여 출력하라.
- 배열 A의 역행렬 (inverse matrix) inv_A를 구하여 출력하라.
- Numpy 확장 모듈의 solve() 함수를 사용하여 선형시스템의 해 X를 산출하고, 이를 출력하라.
- Numpy 확장 모듈의 matmul() 함수를 사용하여 행렬 곱셈 B1 = A*X를 계산하여 출력하고, 이를 행렬 B 와 비교하라.
- Numpy 확장 모듈의 matmul() 함수를 사용하여 행렬 곱셈 X1 = inv_A*B를 계산하여 출력하고, 이를 행렬 X와 비교하라.
- 프로그램 출력 첫 부분에 "2022-1 컴사파 Exam2C 학번: 00000000, 성명: 홍길동" 양식으로 본인 학번 과 이름을 출력할 것.



(2) main() 함수 예시

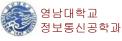
```
. . . . # 기본 주석문
. . . . . # numpy의 import
# 핵심 기능 구현
# 선형시스템 AX = B에서 A와 B의 준비
# - numpy 배열 A의 생성 및 출력
# - numpy 배열 B의 생성 및 출력
# - 배열 A의 행렬식 (det_A) 계산 및 출력
# - 배열 A의 역행렬 (inv_A) 계산 및 출력
# - 선형시스템 AX = B의 해 (solution)인 X의 산출 및 출력
# - B1 = A * X의 계산 및 B1 출력
# - X1 = inv_A * B의 계산 및 X1 출력
```



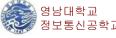
(3) IDLE shell 출력

(4) 결과물 제출

- 파이썬 소스코드 (Exam2C_학번_성명.py)
- 실행 결과 (capture된 이미지) (Exam2C실행결과_실행결과_학번_성명.png)



```
# Exam2C - Numpy-based Linear System Solution
# <기본 주석문>
# Author:
# Date :
# Brief description:
import numpy as np
print("2022-1 컴사파 Exam2C 학번: 0000, 이름: 홍길동")
A = np.array([[1, 5, 3, 3, 7], [3, 4, 5, 6, 7], [1, 3, 5, 7, 9], [3, 1, 4, 1, 5], [5, 5, 3, 3, 1]])
B = np.array([105, 135, 145, 74, 75])
print("A = \n", A)
print("B = \n", B)
det A = np.linalg.det(A)
print("det A = \n", det A)
inv A = np.linalg.inv(\overline{A})
print("inv_A =\n", inv_A)
X = \text{np.linalg.solve}(A, B)
print("X = \n", X)
B1 = np.matmul(A, X)
print("B1 = A * X = \n", B1)
X1 = np.matmul(inv_A, B)
print("\dot{X}1 = inv \ \dot{A} * \vec{B} = \dot{n}", X1)
```

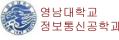


Exam2D

◆ Exam2D. (40점, 시험 시간 (11:15 ~ 12:00) 45분)

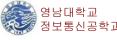
(1) 요구사항

- 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 2 자리 까지 출력할 것.
- 주어진 float 자료형 리스트를 오름차순으로 병합 정렬하는 함수 mergeSort(L)을 사용자 정의 모듈 MySortings.py에 구현하라.
- 주어진 float 자료형 리스트를 오름차순으로 퀵정렬하는 함수 quickSort(L)을 사용자 정의 모듈 MySortings.py에 구현 하라.
- main() 함수에서는 난수 리스트의 크기 (L_size)가 포함된 리스트를 사용하여 전체 기능 시험이 반복구조로 실행되도 록 하라.
- main() 함수에서 genRandFloatList() 함수를 사용하여 중복되지 않는 난수 리스트를 생성한 후, printFloatListSampe() 함수를 사용하여 출력하며, mergeSort() 함수를 사용하여 정렬한 후, 정렬된 리스트를 출력하라.
- main() 함수에는 정렬된 리스트를 random모듈의 shuffle() 함수를 사용하여 뒤섞은 후, 출력하고, quickSort() 함수를 사용하여 오름차순으로 정렬한 후, 출력하라.
- 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 출력 할 것.



(2) main() 함수 예시

```
# 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()
```

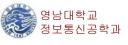


(3) shell 입출력 예시

2022-1 世紀五										
Generating n	andre list	of also (t	000001							Denerating random list of size (500000) Before mergeSort of L :
Before merge										1461,48 -1845,23 1559,76 -1462,89 -1922,73 -2061,88 2190,68 -485,72 -147,18
173.74	-36.61	-203.02	221,48	86.78	-23.76	471.33	148.47	330.72	-440.90	1632.93 1301.93 997.26 -28.75 293.18 -1077.94 1768.14 -255.38 -2272.32
339,66	+78.35	42,90	386.59	-467,63	-413.48	-343,66	329,73	57.05	-38,90	-2355.00 1448.34 -47.92 -2194.31 -994.67 2012.45 -1926.99 1242.35 1557.95
46,88	170,32	15.06	426.36	378.96	120.77	483,73	419.50	307.74	-261.62	-592.49 1263.65 -1863.66 -801.75 -589.64 1816.43 -1025.20 -2058.83 2368.60
275.81	-152.00	381.92	30.30	-391.04	-249.12	-457.98	-254-62	-393.87	-149.85	-618.51 -574.08 441.55 -644.31 -1306.06 48.77 -2337.33 92.27 513.76
-430.15	163.85	-105.61	10.17	-233.17	195.43	-56.40	418.69	388.85	-387.11	659.38 2222.36 -1339.84 -1658.99 -2129.64 1148.52 602.91 -2096.59 -708.36
17.33	-91.55	400.41	492.66	301.07	437.89	-496.05	27.72	257.98	305.11	
										After mergeSort of L :
After mergeS	ort of L :		200		100000		1000			-2500.00 -2499.99 -2499.98 -2499.97 -2499.96 -2499.95 -2499.94 -2499.93 -2499.92 -2499.90 -2459.89 -2459.88 -2459.87 -2459.86 -2459.85 -2459.84 -2459.83 -2459.82
-500.00 -499.98	-499.99 -499.89	-499,98 -499,88	-499.97 -499.87	-499.96 -499.86	-499.95 -499.85	-499.94 -499.84	-499.93 -499.83	-499.92 -499.82	-499.91 -499.81	-2499.00 -2499.79 -2499.77 -2499.77 -2499.76 -2499.75 -2499.74 -2499.75
-499.58	-499.79	-499,78	-499.77	-499,76	-499.85	-499.74	-499.73	-499.72	-499.71	
								-400172		2499.70 2499.71 2499.72 2499.73 2499.74 2499.75 2499.76 2499.77 2499.78
499.70	499.71	499.72	499.73	499.74	499.75	499.76	499.77	499.78	499.79	2499.88 2499.81 2499.82 2499.83 2499.84 2499.85 2499.86 2499.87 2499.88
499.80	499.81	499.82	499.83	499.84	499.85	499.86	499.87	499.88	499.89	2499.90 2499.91 2499.92 2499.93 2499.94 2499.95 2499.96 2499.97 2499.98
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-500000) took 1.366985020263428 sec Before quickSort of L :
erge sorting efore quick	g of list	(511e-10000	e) took e.z	31696382955	93262 sec					1082-91 -1147-62 1614.77 -1452.32 -2017.14 911.76 971.16 500.47 -1232.19
	-248.41	-30.56	432,42	-69.34	-130.83	188.41	+325.44	34,57	-216.06	-1752,47 -839,60 -1357,66 -859,77 1509,12 -1048,82 617,55 -531,29 -1948,14
45.00	48.63	-160.47	-343.47	-361.35		-66.79	-52.58	450,70	-135.04	-2495.51 -2286.66 1032.27 -1323.58 -1511.60 -446.30 1193.48 983.80 1565.55
316.37	+487,39	230,46	-439.70	-399.65	+63.52	-63.10	-199.91	41.71	423.75	
										-1476.23 -423.66 -2379.32 -2176.28 -14.60 2014.53 2326.22 706.14 1388.26
-489,99	385.88	-379.48	-245.44	383.34	217.95	7,44	-154.87	-26.96	488.39	-2156.43 -612.29 -1843.69 -1573.63 881.48 -894.65 -2441.77 -823.59 -1434.99 -899.42 518.79 -2028.78 -1045.80 -38.12 -1924.16 2120.50 -620.95 2332.78
87.89 -365.44	-54.61 177.57	-319.85 42.99	89.73 -225.27	94.29	-311.85 -456.78	294.32 334.78	-447.31 -91.57	-420.16 -365.38	-481,14 -179,98	-899.42 518.78 -2028.78 -1045.80 -38.12 -1924.16 2120.50 -620.95 2332.78 After quickSort of L :
ter quickS			*225.27	24,29		334,75	192.57	1303.30	-210130	arter quicksort of : -250,00 -2409,90 -2409,98 -2409,97 -2409,96 -2409,95 -2409,94 -2409,93 -2409,92
-500.00	+499.99	-499,58	-499.97	-499.96	-499.95	-499.94	-499.93	-499.92	-499,91	-2499.90 -2499.89 -2499.88 -2499.87 -2499.86 -2499.85 -2499.84 -2499.83 -2499.82
-499.98	-499.89	-499.88	-499.87	-499.86	-499.85	-499.84	-499.83	-499.82	-499.81	-2499.88 -2499.79 -2499.78 -2499.77 -2499.76 -2499.75 -2499.74 -2499.73 -2499.72
-499.88	+499.79	-499.78	-499.77	-499.76	-499.75	-499.74	-499.73	-499.72	-499.71	****
						Vacation 1				2499.76 2499.71 2499.72 2499.73 2499.74 2499.75 2499.76 2499.77 2499.78
499.70	499.71	499.72	499.73	499.74	499.75	499.76	499.77	499.78	499.79	2499.88 2499.81 2499.82 2499.83 2499.84 2499.85 2499.86 2499.87 2499.88 2499.90 2499.91 2499.92 2499.93 2499.94 2499.95 2499.96 2499.97 2499.98
499,90	499.91	499.92	499.83	499.94	499.85	499.00	499.87	499.98	499.99	Quick sorting of list (size-500000) took 1,055247545202009 sec
merating ran		of size (10	00000)							Generating random list of size (5000000)
one mengeso	rt of L t	of size (10	59,50	2902.36	2107.83	2726,87	-301.17	-4093,81	1687.99	Generating random list of size (5000000) Serious marginary of 1: 5306.47 9486.48 14189,70 :15110.17 4300.39 -13034.59 -257.10
ore merge50 149.96 1881.90	rt of L : -995.22 4553.06	4030.43 3267,11	59.90 879.30	-4663.93	-3500.58	3290.62	+381,15	1362.07	-4520,56	Before mergefort of L: -4473_18 -16561_35
re mergeSo 149.96 1881.90	rt of L : -995.22 4553.06	4030.43	59.90	-4663.93	-3500.58					Before mergeSort of L : -4473.18 -16561.35 5705.67 9486.40 14183.20 -15110.17 4390.39 -13834.50 -257.10
one mergeSo 149,96 1881,90 3594,92	rt of L: -995.22 4553.86 -2384.46	4030.43 3267.11 4791.26	59.90 879.30 3006,04	-4663.93 4171.23	-3500.58 -4071.56	3290.62 -2620.43	-301.15 -777.72	1362.07 -669.34	-4520.56 -2990.44	Before engglect of Li: -4473.31 - (1964.135 - 5795.47 9486.48 24385.29 -15118.17 4398.39 -11894.50 -2971.8 1594.51 - (1964.136 - 7971.17 5436.8 27112.79 11877.6 -12871.74 44972.3 14896.43 -1986.55 - (1996.18) - (1997.55 - 1987.79 - 3444.8 959.67 11987.79 124877.2 - 24877.2
re mergeSo 149,96 1881.98 1594.92	-995.22 4553.86 2384.46 	4030.43 3267.11 4791.26 3834.99	59.90 879.30 3006.04	-4663.93 4171.23 4691.34	-3580.58 -4071.56 -4357.66	3290.62 -2620.43 -3105.65	-301.15 -777.72 -1316.14	1362.87 -669.34 -3802.88	-4520.56 -2990.44 1209.61	Before surgelect of 1, 11 4477,18 1 6564,155 5785,67 9466,40 1419,109 15110,17 4390.39 11034,59 257,10 1594,51 4030.30 791,11 5083,58 2118,79 1397,61 1397,61 4398,39 14023,30 1609,62 -13481,59 14909,19 17079,95 9912,07 6341,61 929,07 1099,97 1240,92 24277,22 -6470,71 566,54 2004,68 2419,90 24275,41 1209,53 2666,11 410,17 2209,14
re mergeSo (49.96 (81.90 (94.92 (77.35 (85.92	rt of L: -995.22 4553.06 2304.46 1154.37 2121.61	4030.43 3267.11 4791.26 3034.99 2291.60	59.90 879.30 3006.04 -2175.56 2949.63	-4663.93 4171.23 4691.34 -3630.15	-3580.58 -4071.56 -4357.66 -2560.20	3290.62 -2620.43 -3105.65 4693.66	-381.15 -777.72 -1316.14 934.59	1362.87 -669.34 -3802.88 -3751.31	-4520,56 -2990,44 1209.61 -4026.02	Before sergelect of L !! -4-472.18 - 15654.15 - 5795.67 9486.48 14305.20 - 15110.17 4390.30 - 1593.40 - 257.10 1594.53 4000.30 751.11 5000
re mergeSo 149,96 881,98 594,92 477,35 385,92	rt of L: -995.22 4553.06 2304.46 1154.37 2121.61	4030.43 3267.11 4791.26 3034.99 2291.60	59.90 879.30 3006.04	-4663.93 4171.23 4691.34	-3580.58 -4071.56 -4357.66	3290.62 -2620.43 -3105.65	-301.15 -777.72 -1316.14	1362.87 -669.34 -3802.88	-4520.56 -2990.44 1209.61	Before surgelect of 1, 11 4477,18 1 6564,155 5785,67 9466,40 1419,109 15110,17 4390.39 11034,59 257,10 1594,51 4030.30 791,11 5083,58 2118,79 1397,61 1397,61 4398,39 14023,30 1609,62 -13481,59 14909,19 17079,95 9912,07 6341,61 929,07 1099,97 1240,92 24277,22 -6470,71 566,54 2004,68 2419,90 24275,41 1209,53 2666,11 410,17 2209,14
re merge5o (49,96 381,96 594,92 477,35 385,92 - merge5or	rt of L: -995.22 4553.86 2384.46 -1154.37 -2121.61 -189.53	4030.43 3267.11 4791.26 3034.99 2291.60 -1818.04	59.90 879.30 3005.04 -2175.56 2949.63 -4736.69	-4663.93 4171.23 4691.34 -3650.15 205.92	-3580.58 -4071.58 -4357.66 -2540.20 4625.04	3290.62 -2620.43 -3105.65 4693.66 -2942.40	-381.15 -777.72 -1316.14 934.59 -645.19	1362.87 -669.34 -3802.88 -3751.31 4795.92	-4520.56 -2990.44 1200.61 -4024.62 -3399.73	Before engelect of L 1 -4472.38 - 15654.25 5795.47 9486.48 24385.29 -15118.17 4398.39 -1393.450 -257.19 1554.51 4288.38 7951.31 5836.88 21312.79 1397.61 -1392.78 44922.39 14894.49 -2597.19 -1588.36 1598.38 7951.31 5836.88 21312.79 1397.61 -1392.78 44922.39 14696.42 -13981.39 14996.79 122482.79 -24277.22 -4676.71 586.34 2022.88 -23389.9 -24277.40 12395.53 26884.11 -51801.77 22496.14 20297.57 -13888.67 22395.79 2723.55 -12895.35 26884.21 -51951.37 24489.39 -855.77 22981.48 6231.79 -38689.13 8186.48 22751.35 1159.89 14996.85 13278.33
re mergeSo (49,96 (81,90 (94,92 (77,35 (85,92 (85,17 mergeSor (80,00	rt of L: -995.22 4553.86 2304.46 - 1154.37 2121.61 189.53 - t of L: 4999.99	4030.43 3267.11 4791.26 3034.99 2291.60 -1818.04	59.90 879.38 3806.84 -2175.56 2949.63 -4736.69	-4663.93 4171.23 4691.34 -3630.15 205.92 -4999.96	-3580.58 -4071.50 -4357.66 -2540.20 4625.04 -4999.95	3290.62 -2620.43 -3105.65 4693.66 -2942.48 -4999.94	-381.15 -777.72 -1316.14 -934.59 -645.19 -4999.93	1362.87 -669.34 -3602.88 -3751.31 4795.92 -4999.92	-4528.56 -2998.44 1289.61 -4826.62 -3399.73	Before engister of 1, 11 4497,13 - 1561,15 - 5706,07 - 9466,48 - 2583,30 - 5116,17 - 4396,39 - 1582,50 - 577,60 4497,13 - 1561,15 - 5706,07 - 9466,48 - 2583,30 - 5116,17 - 4396,39 - 1582,50 - 577,60 -1361,50 - 1396,13 - 12975,50 - 9812,7 - 1364,81 - 1367,76 - 1362,77 - 1246,10 - 1367,76 - 1362,77 - 1246,10 - 1367,76 - 1362,77 - 1246,10 - 1367,76 - 136
e mergeSo 49,96 81,90 94,92 - 77,35 85,92 - 65,17 mergeSor 00,00 - 99,90	rt of L : -995.22 4553.06 2384.46 .1154.37 2121.61 189.53 t of L : 4999.99 4999.89	4030.43 3267.11 4791.26 3034.99 2291.60 -1818.04 -4999.98 -4999.88	59.90 879.30 3006.04 -2175.56 2949.63 -4736.69 -4999.97 -4999.87	-4663.93 4171.23 4691.34 -3630.15 205.92 -4999.96 -4999.86	-3500,58 -4071,58 -4357,66 -2560,20 4625,04 -4999,95 -4999,85	3290.62 -2620.43 -3105.65 4693.66 -2942.40 -4999.94 -4999.84	-301.15 -777.72 -1316.14 934.59 -645.19 -4999.93 -4999.83	1362.87 -669.34 -3802.88 -3751.31 4795.92 -4999.92 -4999.82	-4529.56 -2398.44 1299.61 -4026.62 -3399.73 -4999.91 -4999.61	Before sengificit of L 1 -4473_18 - 1564_1.35 - 5795_4.7 9486_4.8 14385_28 - 15118_1.7 4396_39 - 1393_4.50 - 257_1.8 1534_5.3 4286_4.8 14385_28 - 15118_1.7 4396_39 - 11893_4.90 - 257_1.8 1534_5.3 4286_4.8 1286_5.8 1286
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re mergeSo 149,96 881,96 881,98 594,92 477,35 385,92 385,17 r mergeSor 000,00 999,00 999,00	rt of L : -995.22 4553.06 2304.46 .1154.37 2121.61 189.53 t of L : 4999.99 4999.89 4999.79	4030.43 3267.11 4791.26 3034.99 2291.60 -1818.04 -4999.98 -4999.88 -4999.88	59,99 879,38 3805,84 -2175,56 2949,63 -4736,69 -4999,97 -4999,87 -4999,77	-4663.93 4171.23 4691.34 -3630.15 205.92 -4999.96 -4999.86 -4999.76	-3580.58 -4071.50 -4357.66 -2540.20 4625.04 -4999.95 -4999.85 -4999.75	3298.62 -2628.43 -3185.65 4693.66 -2942.40 -4999.94 -4999.84 +4999.74	-381.15 -777.72 -1316.14 -934.59 -645.19 -4999.83 -4999.83 -4999.73	1362.87 -669.34 -3602.88 -3751.31 4795.92 -4999.92 -4999.82 -4999.72	-4526,56 -2996,44 1299,61 -4026,62 -3399,73 -4999,81 -4999,81 -4999,71	Before sergelect of L 1 -4472.13 - (1961.15 S) 5795.67 9486.48 14305.20 - 15110.17 4396.39 - 11093.49 - 257.10 1534.51 4206.30 751.11 5083.53 6 21327.39 11097.61 - 13057.74 4396.39 - 11093.49 - 257.10 1534.51 4206.30 751.11 5085.43 6 21327.39 11097.61 - 13057.74 40627.30 16096.42 - 13041.39 - 13097.19 14097.91 22407.22 - 24277.22 - 24279.27 14097.71 14097.91 1
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(4) 결과물 제출

- 사용자 정의 모듈 (MyList.py, MySortings.py), 파이썬 소스코드 (Exam2D_학번_성명.py)
- 실행 결과 (capture된 이미지) (Exam2D실행결과_학번_성명.png)

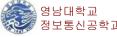


```
# Exam2d - Performance Comparisons of Sorting Algorithms (quickSort, mergeSort) (1) # <기본 주석문>
# Author:
# Date:
# Brief description:
import os, sys, random, time
import MyList, MySortings
def main():
  print("2022-1 컴사파 기말고사 학번: 0000, 이름: 홍길동")
L = [100000, 500000, 1000000, 5000000]
  for L size 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.printFloatListSamplé(L, 10, 3)
     time elapsed = t2 - t1
     print("Quick sorting of list (size={}) took {} sec".format(L size, time elapsed))
    name == " main ":
  main()
```

```
# MyList.py (1)
# <기본 주석문>
# Author:
# Date:
# Brief description:
import random

def genRandFloatList(size):
L = []
offset = - size / 200
for i in range(size):
d = (i / 100) + offset
L.append(d)
random.shuffle(L)
return L
```

```
# MyList.py (2)
def printFloatListSample(L, per_line = 10, sample_lines = 3):
  count = 0
  size = len(L)
  for i in range(0, sample lines):
     for j in range(0, per_line):
        if count > size:
          break
        s += "{0:>10.2f} ".format(L[count])
        count += 1
     print(s)
     if count >= size:
        break
  if count < size:
     print(' . . . . . . ')
     if count < (size - per_line * sample_lines):</pre>
        count = size - per line * sample lines
     for i in range(0, sample lines):
        s = ""
        for j in range(0, per line):
          if count >= size:
             break
          s += "{0:>10.2f} ".format(L[count])
          count += 1
        print(s)
        if count >= size:
          break
```

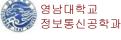


```
# MySorting.py (1)
# <기본 주석문>
# Author:
# Date:
# Brief description:
# mergeSort()
def mergeSort(arr):
  def merge(arr left, arr right):
     arr result = []
     i, j = 0, 0
     while i < len(arr left) and j < len(arr right):
        if arr left[i] < arr right[j]:
          arr result.append(arr left[i])
          i += 1
        else:
          arr result.append(arr right[j])
          i += 1
     while (i < len(arr left)):
        arr result.append(arr left[i])
        i += 1
     while (j < len(arr right)):
        arr_result.append(arr_right[j])
       i += 1
     return arr result
  if len(arr) < 2:
     return arr[:]
  else:
     middle = len(arr) // 2
     left = mergeSort(arr[:middle])
     right = mergeSort(arr[middle:])
     return merge(left, right)
```

```
# MySorting.py (2)
# quickSort()
def quickSort(arr):
   def _partition(arr, left, right, pivot):
     pv = arr[pivot]
     arr[pivot], arr[right] = arr[right], arr[pivot]
     npi = i = left # npi: new pivot index
     while (i<=right-1):
        if (arr[i] <= pv):
           arr[npi], arr[i] = arr[i], arr[npi]
           npi += 1
        i += 1
     arr[npi], arr[right] = arr[right], arr[npi]
     return npi
  def quickSortLoop(arr, left, right):
     #print("quickSort", left, right)
     if (left >= right):
        return
     pi = (left + right)//2
     new pi = partition(arr, left, right, pi)
     #print("after partition : ", left, right, new pi)
     if (left < new pi -1):
         quickSortLoop(arr, left, new_pi-1)
     if (new pi + 1 < right):
        quickSortLoop(arr, new pi+1, right)
  size = len(arr)
   quickSortLoop(arr, 0, size-1)
```

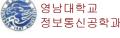
2022-1 컴사파 기말고사 학번: 0000, 이름: 홍길동

Generating r	andom list	of size (10	9999)						
Before merge			3000)						
-135.56	132.99	376.16	-187.64	207.17	482.27	-361.96	-187.12	452.25	499.07
-479.45	405.69	-449.81	102.35	-115.65	-362.71	-149.56	-350.09	112.67	354.74
341.79	-196.17	149.85	-26.62	-109.73	67.60	187.70	325.16	376.09	499.76
-71.18	271.10	396.99	-10.41	-466.55	131.24	-461.05	196.41	-310.24	-80.51
-248.53	365.96	-420.06	453.42	480.74	-194.74	-365.28	334.59	-352.13	-325.79
-90.55	448.50	322.73	345.39	291.52	-427.87	142.89	192.30	-347.78	-486.93
After mergeS	ort 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 sortin	•	A CONTRACTOR OF THE PARTY OF TH) took 0.22	54199981689	453 sec				
Merge sortin Before quick	Sort of L	A CONTRACTOR OF THE PARTY OF TH) took 0.22	54199981689	453 sec				
	•	A CONTRACTOR OF THE PARTY OF TH	192.04	347.79	332.06	421.29	-486.45	-471.51	-360.91
Before quick	Sort of L	:	Transport Parts			421.29 -124.42	-486.45 243.64	-471.51 -362.25	-360.91 -248.92
Before quick 366.78	Sort of L 467.63	117.12	192.04	347.79	332.06				
Before quick 366.78 -251.19 -60.16	Sort of L 467.63 -406.70 -187.99	117.12 147.36 -369.00	192.04 -1.06 -313.57	347.79 271.02 437.73	332.06 127.04 -111.90	-124.42 163.07	243.64 -9.95	-362.25 141.81	-248.92 133.81
Before quick 366.78 -251.19 -60.16 477.71	Sort of L 467.63 -406.70 -187.99 -234.37	117.12 147.36 -369.00	192.04 -1.06 -313.57 285.29	347.79 271.02 437.73 462.39	332.06 127.04 -111.90	-124.42 163.07 -44.88	243.64 -9.95 30.54	-362.25 141.81 291.41	-248.92 133.81 387.22
8efore quick 366.78 -251.19 -60.16 477.71 -291.08	467.63 -406.70 -187.99 	117.12 147.36 -369.00 10.73 -383.12	192.04 -1.06 -313.57 285.29 -41.12	347.79 271.02 437.73 462.39 -178.42	332.06 127.04 -111.90 -400.47 165.21	-124.42 163.07 -44.88 -101.69	243.64 -9.95 30.54 -478.67	-362.25 141.81 291.41 -112.50	-248.92 133.81 387.22 -2.90
Before quick 366.78 -251.19 -60.16 477.71 -291.08 -52.63	467.63 -406.70 -187.99 	117.12 147.36 -369.00	192.04 -1.06 -313.57 285.29	347.79 271.02 437.73 462.39	332.06 127.04 -111.90	-124.42 163.07 -44.88	243.64 -9.95 30.54	-362.25 141.81 291.41	-248.92 133.81 387.22
Before quick 366.78 -251.19 -60.16 477.71 -291.08 -52.63 After quickS	467.63 -406.70 -187.99 -234.37 114.91 16.62	117.12 147.36 -369.00 10.73 -383.12 -301.33	192.04 -1.06 -313.57 285.29 -41.12 -413.50	347.79 271.02 437.73 462.39 -178.42 -225.23	332.06 127.04 -111.90 -400.47 165.21 93.48	-124.42 163.07 -44.88 -101.69 227.06	243.64 -9.95 30.54 -478.67 64.24	-362.25 141.81 291.41 -112.50 -6.76	-248.92 133.81 387.22 -2.90 310.67
Before quick 366.78 -251.19 -60.16 477.71 -291.08 -52.63 After quickS -500.00	467.63 -406.70 -187.99 -234.37 114.91 16.62 fort of L: -499.99	117.12 147.36 -369.00 10.73 -383.12 -301.33	192.04 -1.06 -313.57 285.29 -41.12 -413.50	347.79 271.02 437.73 462.39 -178.42 -225.23	332.06 127.04 -111.90 -400.47 165.21 93.48	-124.42 163.07 -44.88 -101.69 227.06 -499.94	243.64 -9.95 30.54 -478.67 64.24 -499.93	-362.25 141.81 291.41 -112.50 -6.76 -499.92	-248.92 133.81 387.22 -2.90 310.67
Before quick 366.78 -251.19 -60.16 477.71 -291.08 -52.63 After quickS -500.00 -499.90	467.63 -406.70 -187.99 -234.37 114.91 16.62 fort of L: -499.99 -499.89	117.12 147.36 -369.00 10.73 -383.12 -301.33 -499.98 -499.88	192.04 -1.06 -313.57 285.29 -41.12 -413.50 -499.97 -499.87	347.79 271.02 437.73 462.39 -178.42 -225.23	332.06 127.04 -111.90 -400.47 165.21 93.48 -499.95 -499.85	-124.42 163.07 -44.88 -101.69 227.06 -499.94 -499.84	243.64 -9.95 30.54 -478.67 64.24 -499.93 -499.83	-362.25 141.81 291.41 -112.50 -6.76 -499.92 -499.82	-248.92 133.81 387.22 -2.90 310.67 -499.91 -499.81
Before quick 366.78 -251.19 -60.16 477.71 -291.08 -52.63 After quickS -500.00	467.63 -406.70 -187.99 -234.37 114.91 16.62 fort of L: -499.99	117.12 147.36 -369.00 10.73 -383.12 -301.33	192.04 -1.06 -313.57 285.29 -41.12 -413.50	347.79 271.02 437.73 462.39 -178.42 -225.23	332.06 127.04 -111.90 -400.47 165.21 93.48	-124.42 163.07 -44.88 -101.69 227.06 -499.94	243.64 -9.95 30.54 -478.67 64.24 -499.93	-362.25 141.81 291.41 -112.50 -6.76 -499.92	-248.92 133.81 387.22 -2.90 310.67
Before quick 366.78 -251.19 -60.16 477.71 -291.08 -52.63 After quickS -500.00 -499.90 -499.80	467.63 -406.70 -187.99 -234.37 114.91 16.62 fort of L: -499.99 -499.89 -499.79	117.12 147.36 -369.00 10.73 -383.12 -301.33 -499.98 -499.88 -499.78	192.04 -1.06 -313.57 285.29 -41.12 -413.50 -499.97 -499.87 -499.77	347.79 271.02 437.73 462.39 -178.42 -225.23 -499.96 -499.86 -499.76	332.06 127.04 -111.90 -400.47 165.21 93.48 -499.95 -499.85 -499.75	-124.42 163.07 -44.88 -101.69 227.06 -499.94 -499.84 -499.74	243.64 -9.95 30.54 -478.67 64.24 -499.93 -499.83 -499.73	-362.25 141.81 291.41 -112.50 -6.76 -499.92 -499.82 -499.72	-248.92 133.81 387.22 -2.90 310.67 -499.91 -499.81 -499.71
Before quick 366.78 -251.19 -60.16 477.71 -291.08 -52.63 After quickS -500.00 -499.90 -499.80 499.70	467.63 -406.70 -187.99 -234.37 114.91 16.62 fort of L: -499.99 -499.89 -499.79	117.12 147.36 -369.00 10.73 -383.12 -301.33 -499.98 -499.88 -499.78	192.04 -1.06 -313.57 285.29 -41.12 -413.50 -499.97 -499.87 -499.77	347.79 271.02 437.73 462.39 -178.42 -225.23 -499.96 -499.86 -499.76	332.06 127.04 -111.90 -400.47 165.21 93.48 -499.95 -499.85 -499.75	-124.42 163.07 -44.88 -101.69 227.06 -499.94 -499.84 -499.74	243.64 -9.95 30.54 -478.67 64.24 -499.93 -499.83 -499.73	-362.25 141.81 291.41 -112.50 -6.76 -499.92 -499.82 -499.72 499.78	-248.92 133.81 387.22 -2.90 310.67 -499.91 -499.81 -499.71 499.79
Before quick 366.78 -251.19 -60.16 477.71 -291.08 -52.63 After quickS -500.00 -499.90 -499.80 499.70 499.80		117.12 147.36 -369.00 10.73 -383.12 -301.33 -499.98 -499.88 -499.78 499.72 499.82	192.04 -1.06 -313.57 285.29 -41.12 -413.50 -499.97 -499.87 -499.77 499.73 499.83	347.79 271.02 437.73 462.39 -178.42 -225.23 -499.96 -499.86 -499.76	332.06 127.04 -111.90 -400.47 165.21 93.48 -499.95 -499.85 -499.75 499.75	-124.42 163.07 -44.88 -101.69 227.06 -499.94 -499.84 -499.74 499.76 499.86	243.64 -9.95 30.54 -478.67 64.24 -499.93 -499.83 -499.73 499.77 499.87	-362.25 141.81 291.41 -112.50 -6.76 -499.92 -499.82 -499.72 499.78 499.88	-248.92 133.81 387.22 -2.90 310.67 -499.91 -499.81 -499.71 499.79 499.89
Before quick 366.78 -251.19 -60.16 477.71 -291.08 -52.63 After quickS -500.00 -499.90 -499.80 499.70 499.80 499.90	Sort of L 467.63 -406.70 -187.99 -234.37 114.91 16.62 fort of L: -499.99 -499.89 -499.79 499.71 499.81 499.91	117.12 147.36 -369.00 10.73 -383.12 -301.33 -499.98 -499.88 -499.78	192.04 -1.06 -313.57 285.29 -41.12 -413.50 -499.97 -499.87 -499.77 499.73 499.83 499.93	347.79 271.02 437.73 462.39 -178.42 -225.23 -499.96 -499.86 -499.76	332.06 127.04 -111.90 -400.47 165.21 93.48 -499.95 -499.85 -499.75 499.75 499.85 499.95	-124.42 163.07 -44.88 -101.69 227.06 -499.94 -499.84 -499.74	243.64 -9.95 30.54 -478.67 64.24 -499.93 -499.83 -499.73	-362.25 141.81 291.41 -112.50 -6.76 -499.92 -499.82 -499.72 499.78	-248.92 133.81 387.22 -2.90 310.67 -499.91 -499.81 -499.71 499.79

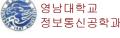


컴퓨팅사고와 파이썬프로그래밍 교수 김영특

Generating	random list	of size (50	00000)						
Before merg									
-1376.39	-707.87	-71.78	-1881.20	-135.42	-2101.80	-807.83	-1609.80	634.05	1132.91
1887.59	755.90	-1449.80	2184.08	-1462.14	557.47	-1590.46	2288.29	-697.28	-1557.91
-1479.39	1695.12	-2204.85	2200.82	-2109.75	-1430.70	-523.17	-390.76	1333.97	-395.07
-1056.51	339.74	2063.48	-2222.57	-954.12	2449.75	539.81	-1812.57	-853.79	-1828.61
1773.10	-1459.87	-2085.11	-433.81	1909.29	-2044.38	1457.04	-232.50	-1651.25	-1741.19
1981.71	-2351.45	749.60	947.90	2393.34	-447.04	-2487.96	-913.86	-1467.71	-766.59
After merge	Sort 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
								Control of the Contro	
•		(size=500000) took 1.3	194940090179					
Merge sorti Before quic	kSort of L) took 1.3						
•			e) took 1.33 -838.04			-1274.12	1347.99	-612.21	1209.85
Before quic	kSort of L	:		194940090179	9443 sec				
Before quic -2053.81	kSort of L 900.54	2221.71	-838.04	194940090179 86.09	9443 sec 1453.16	-1274.12	1347.99	-612.21	1209.85
Before quic -2053.81 1542.14	kSort of L 900.54 1864.19 1883.70	: 2221.71 -1470.13 -2443.04	-838.04 1826.31	86.09 2443.44	9443 sec 1453.16 37.59	-1274.12 990.88	1347.99 2012.77	-612.21 -2003.35	1209.85 -43.89
Before quic -2053.81 1542.14 474.55 	kSort of L 900.54 1864.19 1883.70	: 2221.71 -1470.13 -2443.04 -2102.80	-838.04 1826.31 -312.24	86.09 2443.44 1234.48 1843.51	9443 sec 1453.16 37.59 -1157.36 622.89	-1274.12 990.88 -1841.39	1347.99 2012.77 -2464.68 1961.31	-612.21 -2003.35 1846.16 2496.77	1209.85 -43.89 -138.29
Before quic -2053.81 1542.14 474.55 -516.93 -643.42	kSort of L 900.54 1864.19 1883.70 2264.94 -1135.03	: 2221.71 -1470.13 -2443.04	-838.04 1826.31 -312.24	86.09 2443.44 1234.48	1453.16 37.59 -1157.36	-1274.12 990.88 -1841.39	1347.99 2012.77 -2464.68	-612.21 -2003.35 1846.16	1209.85 -43.89 -138.29
Before quic -2053.81 1542.14 474.55 -516.93 -643.42 1524.28	kSort of L 900.54 1864.19 1883.70 -2264.94 -1135.03 -55.84	: 2221.71 -1470.13 -2443.04 -2102.80 2411.95 782.18	-838.04 1826.31 -312.24	86.09 2443.44 1234.48 1843.51	9443 sec 1453.16 37.59 -1157.36 622.89	-1274.12 990.88 -1841.39	1347.99 2012.77 -2464.68 1961.31	-612.21 -2003.35 1846.16 2496.77	1209.85 -43.89 -138.29
Before quic -2053.81 1542.14 474.55 -516.93 -643.42	kSort of L 900.54 1864.19 1883.70 -2264.94 -1135.03 -55.84	: 2221.71 -1470.13 -2443.04 -2102.80 2411.95 782.18	-838.04 1826.31 -312.24 -1171.82 591.97	86.09 2443.44 1234.48 1843.51 -335.16	9443 sec 1453.16 37.59 -1157.36 622.89 -1563.36	-1274.12 990.88 -1841.39 -711.99 -613.16	1347.99 2012.77 -2464.68 1961.31 -41.05	-612.21 -2003.35 1846.16 2496.77 -864.07	1209.85 -43.89 -138.29 1148.25 -1529.32
Before quic -2053.81 1542.14 474.55 -516.93 -643.42 1524.28	kSort of L 900.54 1864.19 1883.70 -2264.94 -1135.03 -55.84	: 2221.71 -1470.13 -2443.04 -2102.80 2411.95 782.18	-838.04 1826.31 -312.24 -1171.82 591.97	86.09 2443.44 1234.48 1843.51 -335.16	9443 sec 1453.16 37.59 -1157.36 622.89 -1563.36	-1274.12 990.88 -1841.39 -711.99 -613.16	1347.99 2012.77 -2464.68 1961.31 -41.05	-612.21 -2003.35 1846.16 2496.77 -864.07	1209.85 -43.89 -138.29 1148.25 -1529.32
Before quic -2053.81 1542.14 474.55 -516.93 -643.42 1524.28 After quick	kSort of L 900.54 1864.19 1883.70 -2264.94 -1135.03 -55.84 Sort of L :	: 2221.71 -1470.13 -2443.04 -2102.80 2411.95 782.18	-838.04 1826.31 -312.24 -1171.82 591.97 741.50	86.09 2443.44 1234.48 1843.51 -335.16 -1025.51	9443 sec 1453.16 37.59 -1157.36 622.89 -1563.36 231.54	-1274.12 990.88 -1841.39 -711.99 -613.16 717.16	1347.99 2012.77 -2464.68 1961.31 -41.05 -1065.99	-612.21 -2003.35 1846.16 2496.77 -864.07 -1139.93	1209.85 -43.89 -138.29 1148.25 -1529.32 -2251.48
Before quic -2053.81 1542.14 474.55 -516.93 -643.42 1524.28 After quick -2500.00	kSort of L 900.54 1864.19 1883.70 -2264.94 -1135.03 -55.84 Sort of L: -2499.99	: 2221.71 -1470.13 -2443.04 -2102.80 2411.95 782.18 -2499.98	-838.04 1826.31 -312.24 -1171.82 591.97 741.50 -2499.97	86.09 2443.44 1234.48 1843.51 -335.16 -1025.51 -2499.96	9443 sec 1453.16 37.59 -1157.36 622.89 -1563.36 231.54 -2499.95	-1274.12 990.88 -1841.39 -711.99 -613.16 717.16	1347.99 2012.77 -2464.68 1961.31 -41.05 -1065.99	-612.21 -2003.35 1846.16 2496.77 -864.07 -1139.93	1209.85 -43.89 -138.29 1148.25 -1529.32 -2251.48
Before quic -2053.81 1542.14 474.55 -516.93 -643.42 1524.28 After quick -2500.00 -2499.90 -2499.80	kSort of L 900.54 1864.19 1883.70 -2264.94 -1135.03 -55.84 Sort of L: -2499.99 -2499.89	: 2221.71 -1470.13 -2443.04 -2102.80 2411.95 782.18 -2499.98 -2499.88 -2499.78	-838.04 1826.31 -312.24 -1171.82 591.97 741.50 -2499.97 -2499.87 -2499.77	86.09 2443.44 1234.48 1843.51 -335.16 -1025.51 -2499.96 -2499.76	9443 sec 1453.16 37.59 -1157.36 622.89 -1563.36 231.54 -2499.95 -2499.85 -2499.75	-1274.12 990.88 -1841.39 -711.99 -613.16 717.16 -2499.94 -2499.84 -2499.74	1347.99 2012.77 -2464.68 1961.31 -41.05 -1065.99 -2499.93 -2499.83 -2499.73	-612.21 -2003.35 1846.16 2496.77 -864.07 -1139.93 -2499.92 -2499.82 -2499.72	1209.85 -43.89 -138.29 1148.25 -1529.32 -2251.48 -2499.91 -2499.81 -2499.71
Before quic -2053.81 1542.14 474.55 -516.93 -643.42 1524.28 After quick -2500.00 -2499.90 -2499.80 2499.70	kSort of L 900.54 1864.19 1883.70 -2264.94 -1135.03 -55.84 Sort of L: -2499.99 -2499.89 -2499.79	: 2221.71 -1470.13 -2443.04 -2102.80 2411.95 782.18 -2499.98 -2499.88 -2499.78	-838.04 1826.31 -312.24 -1171.82 591.97 741.50 -2499.97 -2499.87 -2499.77 2499.73	86.09 2443.44 1234.48 1843.51 -335.16 -1025.51 -2499.96 -2499.86 -2499.76	9443 sec 1453.16 37.59 -1157.36 622.89 -1563.36 231.54 -2499.95 -2499.75 2499.75	-1274.12 990.88 -1841.39 -711.99 -613.16 717.16 -2499.94 -2499.74 2499.76	1347.99 2012.77 -2464.68 1961.31 -41.05 -1065.99 -2499.93 -2499.83 -2499.73	-612.21 -2003.35 1846.16 2496.77 -864.07 -1139.93 -2499.92 -2499.82 -2499.72	1209.85 -43.89 -138.29 1148.25 -1529.32 -2251.48 -2499.91 -2499.81 -2499.79
Before quic -2053.81 1542.14 474.55 -516.93 -643.42 1524.28 After quick -2500.00 -2499.90 -2499.80 2499.70 2499.80	kSort of L 900.54 1864.19 1883.70 -2264.94 -1135.03 -55.84 Sort of L: -2499.99 -2499.89 -2499.79 2499.71	: 2221.71 -1470.13 -2443.04 -2102.80 2411.95 782.18 -2499.98 -2499.88 -2499.78 2499.72 2499.82	-838.04 1826.31 -312.24 -1171.82 591.97 741.50 -2499.97 -2499.87 -2499.77 2499.73 2499.83	86.09 2443.44 1234.48 1843.51 -335.16 -1025.51 -2499.96 -2499.86 -2499.76 2499.74 2499.84	1453.16 37.59 -1157.36 622.89 -1563.36 231.54 -2499.95 -2499.85 -2499.75 2499.85	-1274.12 990.88 -1841.39 -711.99 -613.16 717.16 -2499.94 -2499.74 2499.76 2499.86	1347.99 2012.77 -2464.68 1961.31 -41.05 -1065.99 -2499.93 -2499.83 -2499.73 2499.77 2499.87	-612.21 -2003.35 1846.16 2496.77 -864.07 -1139.93 -2499.92 -2499.82 -2499.72 2499.78 2499.88	1209.85 -43.89 -138.29 1148.25 -1529.32 -2251.48 -2499.91 -2499.81 -2499.71 2499.79 2499.89
Before quic -2053.81 1542.14 474.55 -516.93 -643.42 1524.28 After quick -2500.00 -2499.90 -2499.80 2499.70 2499.80 2499.90	kSort of L 900.54 1864.19 1883.70 -2264.94 -1135.03 -55.84 Sort of L: -2499.99 -2499.89 -2499.79 2499.71 2499.81 2499.91	: 2221.71 -1470.13 -2443.04 -2102.80 2411.95 782.18 -2499.98 -2499.88 -2499.78	-838.04 1826.31 -312.24 -1171.82 591.97 741.50 -2499.97 -2499.87 -2499.77 2499.73 2499.83 2499.93	86.09 2443.44 1234.48 1843.51 -335.16 -1025.51 -2499.96 -2499.86 -2499.76	9443 sec 1453.16 37.59 -1157.36 622.89 -1563.36 231.54 -2499.95 -2499.85 -2499.75 2499.85 2499.95	-1274.12 990.88 -1841.39 -711.99 -613.16 717.16 -2499.94 -2499.74 2499.76	1347.99 2012.77 -2464.68 1961.31 -41.05 -1065.99 -2499.93 -2499.83 -2499.73	-612.21 -2003.35 1846.16 2496.77 -864.07 -1139.93 -2499.92 -2499.82 -2499.72	1209.85 -43.89 -138.29 1148.25 -1529.32 -2251.48 -2499.91 -2499.81 -2499.79



		of size (1	000000)						
Before merg								101201 0101	
2574.25	-4305.15	2393.93	-1105.14	-2845.08	4740.57	2658.70	-2854.85	339.32	-4402.28
-4841.18	1170.94	98.92	-4425.43	2921.36	-2283.79	3885.08	-1180.41	-3071.97	1380.41
-338.87	4635.99	4923.23	-680.86	-4286.07	1634.92	1016.55	773.60	2895.11	-3719.32
-3864.14	-4220.79	1105.96	-3241.59	4577.36	-1795.93	-315.51	1095.93	-389.16	-14.03
3195.83	-3073.58	-3317.10	-929.62	3304.06	1557.89	1893.89	2980.16	4804.26	2209.50
-4569.25	3363.88	-4177.78	454.21	-1898.31	912.81	-4462.03	788.51	-1946.11	1004.81
After merge	Sort 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
		(size=10000	00) took 2.	82740497589	11133 sec				
Merge sorti Before quic	kSort of L		00) took 2.	82740497589:	11133 sec				
			2449.00	1839.78	11133 sec -1379.78	2308.77	3337.70	-1074.36	1315.05
Before quic	kSort of L	:				2308.77 -2632.81	3337.70 -787.86	-1074.36 2997.89	1315.05 1275.12
Before quic 1716.75	kSort of L -3404.87	-2562.36	2449.00	1839.78	-1379.78		Control of the Control		
Before quic 1716.75 1873.79	kSort of L -3404.87 -4905.41 -2858.59	: -2562.36 1810.49	2449.00 3252.46	1839.78 4401.89	-1379.78 -172.90	-2632.81	-787.86	2997.89	1275.12
Before quic 1716.75 1873.79 2786.31	kSort of L -3404.87 -4905.41 -2858.59	: -2562.36 1810.49	2449.00 3252.46	1839.78 4401.89	-1379.78 -172.90	-2632.81	-787.86	2997.89	1275.12
Before quic 1716.75 1873.79 2786.31	kSort of L -3404.87 -4905.41 -2858.59	-2562.36 1810.49 2067.16	2449.00 3252.46 -888.97	1839.78 4401.89 1222.17	-1379.78 -172.90 -4024.24	-2632.81 -2685.82	-787.86 -894.66	2997.89 -461.35	1275.12 2049.85
Before quic 1716.75 1873.79 2786.31 802.01	kSort of L -3404.87 -4905.41 -2858.59 -406.65	: -2562.36 1810.49 2067.16 4998.22	2449.00 3252.46 -888.97	1839.78 4401.89 1222.17 1910.05	-1379.78 -172.90 -4024.24 4350.52	-2632.81 -2685.82 -3818.31	-787.86 -894.66 1952.28	2997.89 -461.35 4456.15	1275.12 2049.85 4891.14
Before quic 1716.75 1873.79 2786.31 -802.01 -1176.15	kSort of L -3404.87 -4905.41 -2858.59 	: -2562.36 1810.49 2067.16 4998.22 3496.63 3927.37	2449.00 3252.46 -888.97 14.46 -2476.54	1839.78 4401.89 1222.17 1910.05 -1122.46	-1379.78 -172.90 -4024.24 4350.52 1253.70	-2632.81 -2685.82 -3818.31 4189.26	-787.86 -894.66 1952.28 -4080.54	2997.89 -461.35 4456.15 3985.78	1275.12 2049.85 4891.14 1576.65
Before quic 1716.75 1873.79 2786.31 -802.01 -1176.15 413.69	kSort of L -3404.87 -4905.41 -2858.59 	: -2562.36 1810.49 2067.16 4998.22 3496.63 3927.37	2449.00 3252.46 -888.97 14.46 -2476.54	1839.78 4401.89 1222.17 1910.05 -1122.46	-1379.78 -172.90 -4024.24 4350.52 1253.70	-2632.81 -2685.82 -3818.31 4189.26	-787.86 -894.66 1952.28 -4080.54	2997.89 -461.35 4456.15 3985.78	1275.12 2049.85 4891.14 1576.65
Before quic 1716.75 1873.79 2786.31 -802.01 -1176.15 413.69 After quick	kSort of L -3404.87 -4905.41 -2858.59 -406.65 2486.11 4777.83 Sort of L :	: -2562.36 1810.49 2067.16 4998.22 3496.63 3927.37	2449.00 3252.46 -888.97 14.46 -2476.54 4452.39	1839.78 4401.89 1222.17 1910.05 -1122.46 3899.16	-1379.78 -172.90 -4024.24 4350.52 1253.70 4945.32	-2632.81 -2685.82 -3818.31 4189.26 -2963.02	-787.86 -894.66 1952.28 -4080.54 1547.85	2997.89 -461.35 4456.15 3985.78 -3586.42	1275.12 2049.85 4891.14 1576.65 2931.75
Before quic 1716.75 1873.79 2786.31 -802.01 -1176.15 413.69 After quick -5000.00	kSort of L -3404.87 -4905.41 -2858.59 -406.65 2486.11 4777.83 Sort of L: -4999.99	: -2562.36 1810.49 2067.16 4998.22 3496.63 3927.37 -4999.98	2449.00 3252.46 -888.97 14.46 -2476.54 4452.39	1839.78 4401.89 1222.17 1910.05 -1122.46 3899.16 -4999.96	-1379.78 -172.90 -4024.24 4350.52 1253.70 4945.32 -4999.95	-2632.81 -2685.82 -3818.31 4189.26 -2963.02 -4999.94	-787.86 -894.66 1952.28 -4080.54 1547.85 -4999.93	2997.89 -461.35 4456.15 3985.78 -3586.42 -4999.92	1275.12 2049.85 4891.14 1576.65 2931.75 -4999.91
Before quic 1716.75 1873.79 2786.31 -802.01 -1176.15 413.69 After quick -5000.00 -4999.90	kSort of L -3404.87 -4905.41 -2858.59 406.65 2486.11 4777.83 Sort of L: -4999.99 -4999.89	: -2562.36 1810.49 2067.16 4998.22 3496.63 3927.37 -4999.98 -4999.88	2449.00 3252.46 -888.97 14.46 -2476.54 4452.39 -4999.97 -4999.87	1839.78 4401.89 1222.17 1910.05 -1122.46 3899.16 -4999.96 -4999.86	-1379.78 -172.90 -4024.24 4350.52 1253.70 4945.32 -4999.95 -4999.85	-2632.81 -2685.82 -3818.31 4189.26 -2963.02 -4999.94 -4999.84	-787.86 -894.66 1952.28 -4080.54 1547.85 -4999.93 -4999.83	2997.89 -461.35 4456.15 3985.78 -3586.42 -4999.92 -4999.82	1275.12 2049.85 4891.14 1576.65 2931.75 -4999.91 -4999.81
Before quic 1716.75 1873.79 2786.31 -802.01 -1176.15 413.69 After quick -5000.00 -4999.90 -4999.80	kSort of L -3404.87 -4905.41 -2858.59 406.65 2486.11 4777.83 Sort of L: -4999.99 -4999.89	: -2562.36 1810.49 2067.16 4998.22 3496.63 3927.37 -4999.98 -4999.88	2449.00 3252.46 -888.97 14.46 -2476.54 4452.39 -4999.97 -4999.87	1839.78 4401.89 1222.17 1910.05 -1122.46 3899.16 -4999.96 -4999.86	-1379.78 -172.90 -4024.24 4350.52 1253.70 4945.32 -4999.95 -4999.85	-2632.81 -2685.82 -3818.31 4189.26 -2963.02 -4999.94 -4999.84	-787.86 -894.66 1952.28 -4080.54 1547.85 -4999.93 -4999.83	2997.89 -461.35 4456.15 3985.78 -3586.42 -4999.92 -4999.82	1275.12 2049.85 4891.14 1576.65 2931.75 -4999.91 -4999.81
Before quic 1716.75 1873.79 2786.31 -802.01 -1176.15 413.69 After quick -5000.00 -4999.90 -4999.80	kSort of L -3404.87 -4905.41 -2858.59 -406.65 2486.11 4777.83 Sort of L: -4999.99 -4999.89	: -2562.36 1810.49 2067.16 4998.22 3496.63 3927.37 -4999.98 -4999.88 -4999.78	2449.00 3252.46 -888.97 14.46 -2476.54 4452.39 -4999.97 -4999.87 -4999.77	1839.78 4401.89 1222.17 1910.05 -1122.46 3899.16 -4999.96 -4999.86 -4999.76	-1379.78 -172.90 -4024.24 4350.52 1253.70 4945.32 -4999.95 -4999.85 -4999.75	-2632.81 -2685.82 -3818.31 4189.26 -2963.02 -4999.94 -4999.84 -4999.74	-787.86 -894.66 1952.28 -4080.54 1547.85 -4999.93 -4999.83 -4999.73	2997.89 -461.35 4456.15 3985.78 -3586.42 -4999.92 -4999.82 -4999.72	1275.12 2049.85 4891.14 1576.65 2931.75 -4999.91 -4999.81 -4999.71
Before quic 1716.75 1873.79 2786.31 -802.01 -1176.15 413.69 After quick -5000.00 -4999.90 -4999.80 4999.70	kSort of L -3404.87 -4905.41 -2858.59 -406.65 2486.11 4777.83 Sort of L: -4999.99 -4999.89 -4999.79	: -2562.36 1810.49 2067.16 4998.22 3496.63 3927.37 -4999.98 -4999.88 -4999.78	2449.00 3252.46 -888.97 14.46 -2476.54 4452.39 -4999.97 -4999.77 4999.77	1839.78 4401.89 1222.17 1910.05 -1122.46 3899.16 -4999.86 -4999.76 4999.74	-1379.78 -172.90 -4024.24 4350.52 1253.70 4945.32 -4999.95 -4999.85 -4999.75	-2632.81 -2685.82 -3818.31 4189.26 -2963.02 -4999.94 -4999.84 -4999.76	-787.86 -894.66 1952.28 -4080.54 1547.85 -4999.93 -4999.83 -4999.73	2997.89 -461.35 4456.15 3985.78 -3586.42 -4999.92 -4999.82 -4999.72 4999.78	1275.12 2049.85 4891.14 1576.65 2931.75 -4999.91 -4999.81 -4999.71 4999.79



Generating	random list	of size (5	000000)						
Before merg	geSort of L	:							
9488.59	-1191.63	15434.71	-4641.09	22833.81	-22371.68	510.14	-13697.12	12739.97	-15613.89
-1471.36	-1537.03	5182.48	-16166.02	2805.90	10231.45	-20346.92	-15599.43	-4641.98	477.12
-22421.08	-2047.88	20458.26	15866.49	2629.45	-13450.64	-15776.13	-9287.63	7336.32	15540.94
17613.88	-22311.97	-22736.41	-18611.62	-15564.77	-1984.54	6279.26	-11552.99	-14484.76	-20314.71
13129.41	1536.20	-14051.02	9978.94	2912.64	21935.68	19664.60	7813.84	-18529.35	-11839.33
-5692.25	-18263.33	5220.10	-3125.05	-22054.54	-5734.21	-16834.25	13428.09	-7221.05	-13055.20
After merge	Sort 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 sorti	ing of list	(size=50000	00) took 17	.2170183658	59985 sec				
Before quic	kSort of L	:							
-19296.14	-2705.46	-19849.81	15740.98	23554.56	-4445.18	7652.22	-18318.17	22880.11	19623.05
16269.45	-4795.56	-7542.58	-16993.18	-4623.19	-7222.81	-2931.38	5902.79	7162.33	-19942.99
-23401.82	18563.99	-17804.10	-16998.04	-20609.45	23275.99	18759.27	-19941.15	18316.58	20719.81
-3083.55	-826.70	17773.76	3941.13	-20930.39	15302.18	-1427.70	-17758.04	-12512.06	10131.54
13426.84	-22497.03	4682.38	3990.35	12244.00	21846.01	8895.56	-22506.65	-1278.84	24457.03
7710.42	-10578.06	10857.06	5805.69	-2623.80	15221.23	-15987.49	-12613.76	22825.26	21657.52
After quick	Sort of L :								
-25000.00	24000 00		04000 07		24000 05	-24999.94		24000 00	-24999.91
-23000.00	-24999.99	-24999.98	-24999.97	-24999.96	-24999.95	-24999.94	-24999.93	-24999.92	-24999.91
-24999.90	-24999.99	-24999.98 -24999.88	-24999.97	-24999.96 -24999.86	-24999.95	-24999.94	-24999.93 -24999.83	-24999.92	-24999.91
-24999.90	-24999.89 -24999.79	-24999.88	-24999.87	-24999.86	-24999.85	-24999.84	-24999.83	-24999.82	-24999.81
-24999.90 -24999.80	-24999.89 -24999.79	-24999.88	-24999.87	-24999.86	-24999.85	-24999.84	-24999.83	-24999.82	-24999.81
-24999.90 -24999.80	-24999.89 -24999.79	-24999.88 -24999.78	-24999.87 -24999.77	-24999.86 -24999.76	-24999.85 -24999.75	-24999.84 -24999.74	-24999.83 -24999.73	-24999.82 -24999.72	-24999.81 -24999.71
-24999.90 -24999.80 24999.70	-24999.89 -24999.79 	-24999.88 -24999.78 24999.72	-24999.87 -24999.77 24999.73	-24999.86 -24999.76 24999.74	-24999.85 -24999.75 24999.75	-24999.84 -24999.74 24999.76	-24999.83 -24999.73 24999.77	-24999.82 -24999.72 24999.78	-24999.81 -24999.71 24999.79

