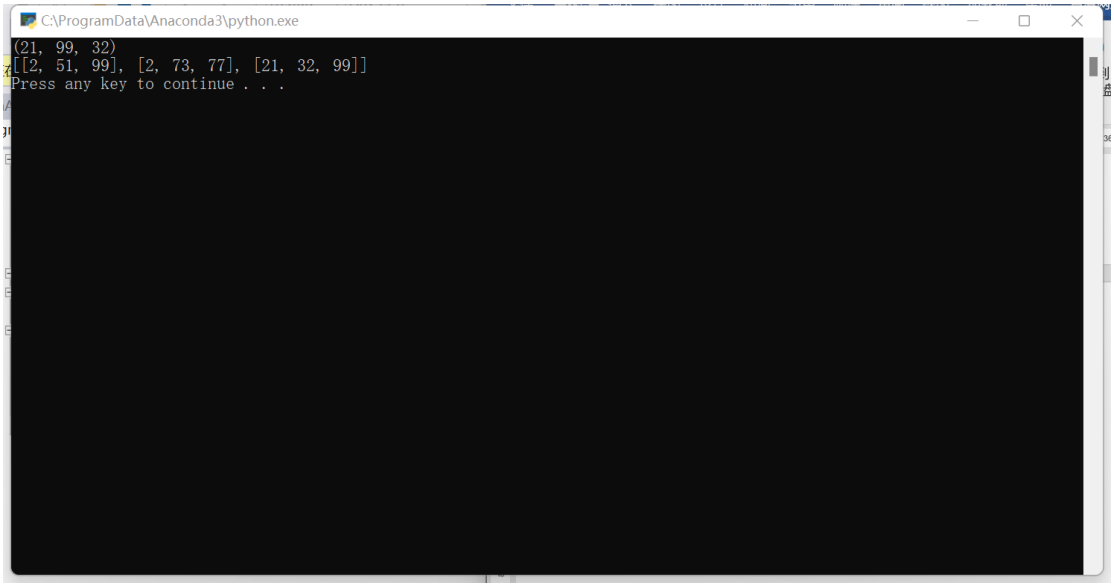
实验1

第一个函数是老师的穷举法；第二个函数是老师的二分查找函数；第三个函数是n^2logn复杂度的函数，算法与老师的思路一致。先排序；排完序建立一个二维list（因为三元组可能不止一个）；然后对b从左往右遍历；对c从b+1开始遍历（防止重复），最后对a从c+1开始二分查找即可。（因为如果a从头开始会产生重复的结果，算法效率也会降低。）找完入栈，最后输出，注意边界条件。

```
def exhaustive_search_3Sum(s, x):
    n = len(s)
    for i in range(n - 2):
        for j in range(i + 1, n - 1):
            for k in range(j + 1, n):
                if s[i] + s[j] + s[k] == x:
                    return s[i], s[j], s[k]
    return ()
s = [21, 73, 6, 67, 99, 60, 77, 5, 51, 32, 2]
x=152
print (exhaustive_search_3Sum(s, 152))
#teacher's code for test
def binary_search(s, k):
    low = 0; high = len(s) - 1
    while low <= high:
        mid = (high + low) // 2
        if k == s[mid]:
            return mid
        elif k < s[mid]:
            high = mid - 1
        else:
            low = mid + 1
    return -1
#teacher's code for binary_search
def lognnum3(s,x):
    s=sorted(s,key=lambda s:s)
    #print(s)
    n=len(s)
    result=[[0 for i in range(0)]for j in range(n^2)]
    pos=0
    for b in range (0,n):
        for c in range(b+1,n):
            a=binary_search(s[c+1:n],x-s[b]-s[c])
            if(a!=-1):
                result[pos].append(s[b])
                result[pos].append(s[c])
                result[pos].append(s[a+c+1])
                pos=pos+1
    return result[0:pos]
```

print(lognnum3(s,x))

第一行是穷举法结果（穷举一个结果就会 return），第二行是我的算法结果




实验 2

注意在 vs 环境下要先写六个“，再把内容粘进注释内，否则容易不识别；字符串名称建议用 s1，s2，s3 的形式，不然容易出 bug；调用 timeit 时后面的%n 在测试程序内以%d 的形式传入，大家找找 s1，s2，s3 内的%d 符号就明白了。

```
s1="""
import random
def insertion_sort(s):
    n = len(s)
    for i in range(1, n):
        value = s[i]
        pos = i
        while pos > 0 and value < s[pos - 1] :
            s[pos] = s[pos - 1]
            pos -= 1
        s[pos] = value
alist=[random.random() for i in range (%d)]
insertion_sort(alist)
"""

s2="""
import random
def merge_ordered_lists(s1, s2):
    t = []
    i = j = 0
    while i < len(s1) and j < len(s2):
        if s1[i] < s2[j]:
            t.append(s1[i]); i += 1
        else:
```

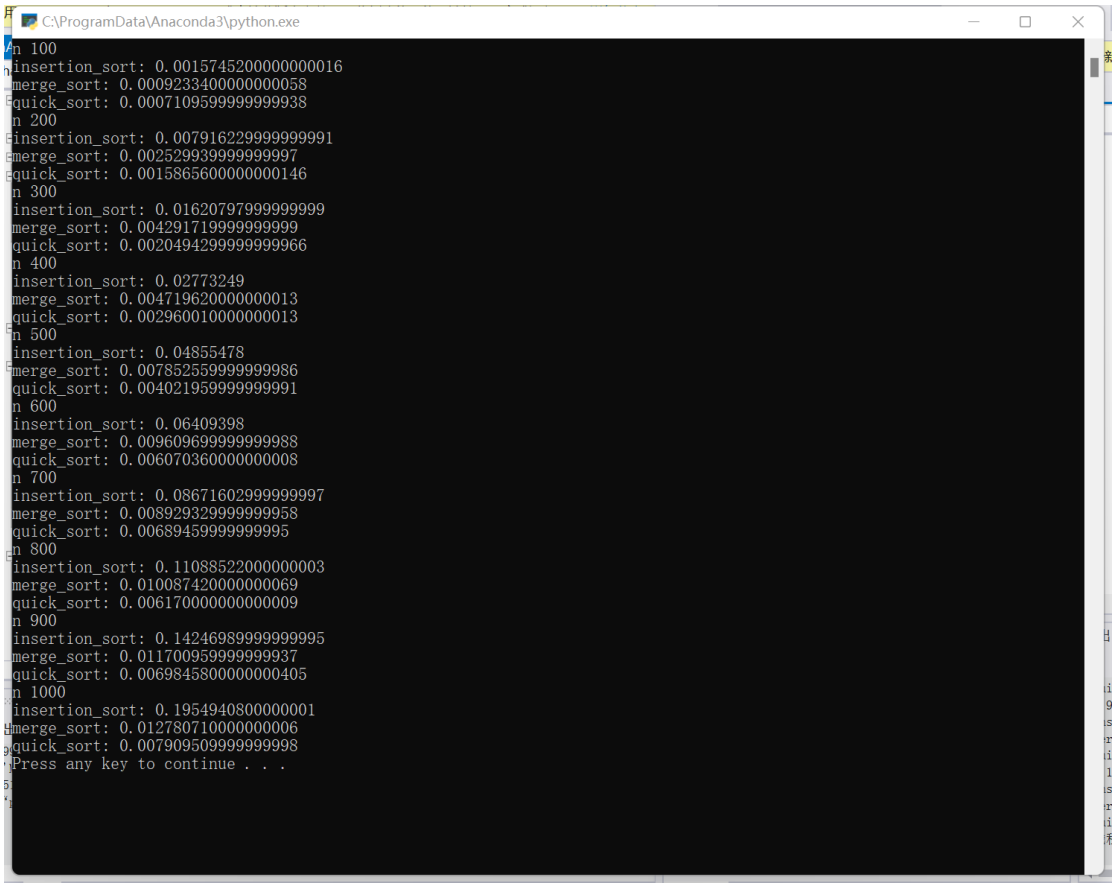
```
            t.append(s2[j]); j += 1
    t += s1[i:]
    t += s2[j:]
    return t
def merge_sort(s):
    if len(s) <= 1:
        return s
    mid = len(s) // 2
    left = merge_sort(s[:mid])
    right = merge_sort(s[mid:])
    return merge_ordered_lists(left, right)
alist=[random.random() for i in range (%d)]
merge_sort(alist)
"""

s3="""
import random
def partition(arr,low,high):
    i = ( low-1 )
    pivot = arr[high]
    for j in range(low , high):
        if   arr[j] <= pivot:

            i = i+1
            arr[i],arr[j] = arr[j],arr[i]

    arr[i+1],arr[high] = arr[high],arr[i+1]
    return ( i+1 )
def quickSort(arr,low,high):
    if low < high:
        pi = partition(arr,low,high)
        quickSort(arr, low, pi-1)
        quickSort(arr, pi+1, high)
alist=[random.random() for i in range (%d)]
quickSort(alist,0,len(alist)-1)
"""
import timeit
import random
for n in range(100,1100,100):
    print("n",n)
    t=timeit.timeit(stmt=s1 % n,number=10) / 10
    print("insertion_sort:",t)
    t=timeit.timeit(stmt=s2 % n,number=10) / 10
    print("merge_sort:",t)
```

```
    t=timeit.timeit(stmt=s3 % n,number=10) / 10
    print("quick_sort:",t)
```




实验 3

记得先在pyder命令行下pip install line_profiler，然后新建一个txt，把以下代码粘入；然后把txt文件改名成merge_sort.py移进C盘，对命令的参数也稍作更改：

C:\anaconda\Scripts\kernprof -l -v C:\merge_sort.py

否则会有问题。

```
import time

@profile
def merge_ordered_lists(s1, s2):
    t = []
    i = j = 0
    while i < len(s1) and j < len(s2):
        if s1[i] < s2[j]:
            t.append(s1[i]); i += 1
        else:
            t.append(s2[j]); j += 1
    t += s1[i:]
    t += s2[j:]
    return t
```

```python
@profile
def merge_sort(s):
    if len(s) <= 1:
        return s
    mid = len(s) // 2
    left = merge_sort(s[:mid])
    right = merge_sort(s[mid:])
    return merge_ordered_lists(left, right)

s = [21, 73, 6, 67, 99, 60, 77, 5, 51, 32]
print(merge_sort(s))
```

```
PS C:\> C:\anaconda\Scripts\kernprof -l -v C:\merge_sort.py
[5, 6, 21, 32, 51, 60, 67, 73, 77, 99]
Wrote profile results to merge_sort.py.lprof
Timer unit: 1e-06 s

Total time: 6.58e-05 s
File: C:\merge_sort.py
Function: merge_ordered_lists at line 3

Line #      Hits         Time  Per Hit   % Time  Line Contents
==============================================================
     3                                           @profile
     4                                           def merge_ordered_lists(s1, s2):
     5         9          3.5      0.4      5.3      t = []
     6         9          3.9      0.4      5.9      i = j = 0
     7        31         18.1      0.6     27.5      while i < len(s1) and j < len(s2):
     8        22         11.1      0.5     16.9          if s1[i] < s2[j]:
     9        11          7.8      0.7     11.9              t.append(s1[i]); i += 1
    10                                               else:
    11        11          7.0      0.6     10.6              t.append(s2[j]); j += 1
    12         9          5.8      0.6      8.8      t += s1[i:]
    13         9          5.9      0.7      9.0      t += s2[j:]
    14         9          2.7      0.3      4.1      return t

Total time: 0.0001736 s
File: C:\merge_sort.py
Function: merge_sort at line 16

Line #      Hits         Time  Per Hit   % Time  Line Contents
==============================================================
    16                                           @profile
    17                                           def merge_sort(s):
    18        19         12.2      0.6      7.0      if len(s) <= 1:
    19        10          4.8      0.5      2.8          return s
    20         9          5.2      0.6      3.0      mid = len(s) // 2
    21         9         14.4      1.6      8.3      left = merge_sort(s[:mid])
    22         9         12.1      1.3      7.0      right = merge_sort(s[mid:])
    23         9        124.9     13.9     71.9      return merge_ordered_lists(left, right)
```