**LAPORAN PRAKTIKUM ALGORITMA DAN STRUKTUR DATA**
**MODUL 6**

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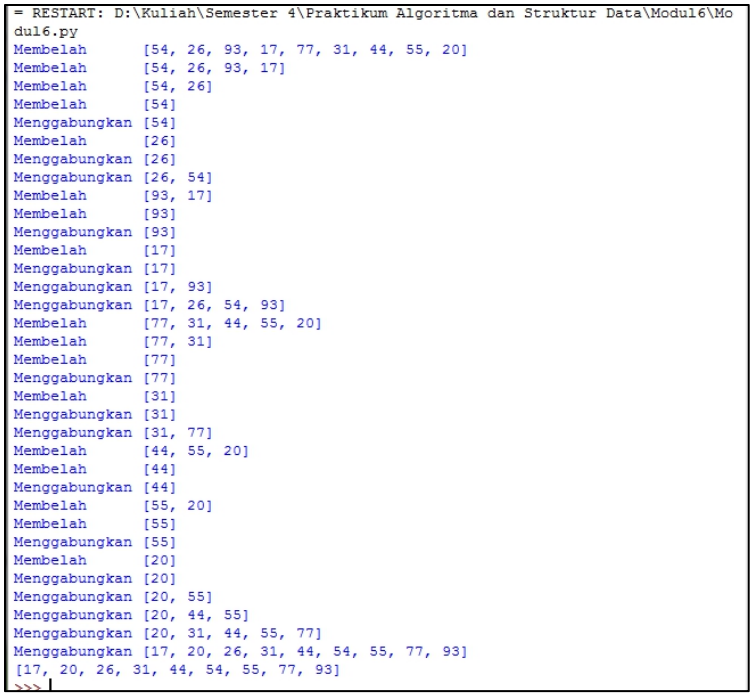
**#============================LATIHAN============================**

```
P = [2, 8, 15, 23, 37]
Q = [4, 6, 15, 20]
def gabungkanDuaListUrut(A, B):
    la = len(A); lb = len(B)
    C = list()
    i = 0; j = 0

    while i <la and j < lb:
        if A[i] < B[j]:
            C.append(A[i])
            i += 1
        else:
            C.append(B[j])
            j += 1

    while i < la:
        C.append(A[i])
        i += 1

    while j < lb:
        C.append(B[j])
        j +=1

    return C
gabungkanDuaListUrut(P,Q)
```

```
= RESTART: D:\Kuliah\Semester 4\Praktikum Algoritma dan Struktur Data\Modul6\Mo
dul6.py
>>> gabungkanDuaListUrut(P,Q)
[2, 4, 6, 8, 15, 15, 20, 23, 37]
>>>
```

```
#============================================================
##def mergeSort(A):
##    print("Membelah     ", A)
##    if len(A) > 1:
##        mid = len(A) // 2
##        separuhKiri = A[:mid]
##        separuhKanan = A[mid:]
##
##        mergeSort(separuhKiri)
##        mergeSort(separuhKanan)
##
##        i=0; j=0; k=0
##        while i < len(separuhKiri) and j < len(separuhKanan):
##            if separuhKiri[i] < separuhKanan[j]:
##                A[k] = separuhKiri[i]
##                i = i + 1
##            else:
##                A[k] = separuhKanan[j]
##                j = j + 1
##            k = k + 1
##
##        while i < len(separuhKiri):
##            A[k] = separuhKiri[i]
##            i = i + 1
##            k = k + 1
##
##        while j < len(separuhKanan):
##            A[k] = separuhKanan[j]
##            j = j + 1
##            k = k + 1
##
##    print("Menggabungkan", A)
##
##alist = [54, 26, 93, 17, 77, 31, 44, 55, 20]
##mergeSort(alist)
##print(alist)
```



```
= RESTART: D:\Kuliah\Semester 4\Praktikum Algoritma dan Struktur Data\Modul6\Mo
dul6.py
Membelah      [54, 26, 93, 17, 77, 31, 44, 55, 20]
Membelah      [54, 26, 93, 17]
Membelah      [54, 26]
Membelah      [54]
Menggabungkan [54]
Membelah      [26]
Menggabungkan [26]
Menggabungkan [26, 54]
Membelah      [93, 17]
Membelah      [93]
Menggabungkan [93]
Membelah      [17]
Menggabungkan [17]
Menggabungkan [17, 93]
Menggabungkan [17, 26, 54, 93]
Membelah      [77, 31, 44, 55, 20]
Membelah      [77, 31]
Membelah      [77]
Menggabungkan [77]
Membelah      [31]
Menggabungkan [31]
Menggabungkan [31, 77]
Membelah      [44, 55, 20]
Membelah      [44]
Menggabungkan [44]
Membelah      [55, 20]
Membelah      [55]
Menggabungkan [55]
Membelah      [20]
Menggabungkan [20]
Menggabungkan [20, 55]
Menggabungkan [20, 44, 55]
Menggabungkan [20, 31, 44, 55, 77]
Menggabungkan [17, 20, 26, 31, 44, 54, 55, 77, 93]
[17, 20, 26, 31, 44, 54, 55, 77, 93]
>>>
```

```
#============================================================
##alist = [54, 26, 93, 17, 77, 31, 44, 55, 20]
##def quickSort(A):
##    quickSortBantu(A, 0, len(A) - 1)
##
##def quickSortBantu(A, awal, akhir):
##    if awal < akhir:
##        titikBelah = partisi(A, awal, akhir)
##        quickSortBantu(A, titikBelah + 1, akhir)
##
##def partisi(A, awal, akhir):
##    nilaiPivot = A[awal]
##
##    penandaKiri = awal + 1
##    penandaKanan = akhir
##
##    selesai = False
##    while not selesai:
##
##        while penandaKiri <= penandaKanan and  A[penandaKiri] <= nilaiPivot:
##            penandaKiri = penandaKiri + 1
##
##        while A[penandaKanan] >= nilaiPivot and penandaKanan >= penandaKiri:
##            penandaKanan = penandaKanan - 1
##
##        if penandaKanan < penandaKiri:
##            selesai = True
##        else:
##            temp = A[penandaKiri]
##            A[penandaKiri] = A[penandaKanan]
```

```
##            A[penandaKanan] = temp
##
##    temp = A[awal]
##    A[awal] = A[penandaKanan]
##    A[penandaKanan] = temp
##
##    return penandaKanan
##
##quickSort(alist)
##print(alist)
```

```
= RESTART: D:\Kuliah\Semester 4\Praktikum Algoritma dan Struktur Data\Modul6\Mo
dul6.py
[31, 26, 20, 17, 44, 54, 55, 77, 93]
>>>
```

**#==========SOAL MAHASISWA==========**

```
#Nomor 1
class MhsTIF(object):
    def __init__(self,nama,nim,tinggal,us):
        self.nama = nama
        self.nim = nim
        self.tinggal = tinggal
        self.us = us

c0 = MhsTIF('Ika', 'L20019001', 'Sukoharjo', 240000)
c1 = MhsTIF('Budi', 'L20019003', 'Sragen', 230000)
c2 = MhsTIF('Ahmad', 'L20019002', 'Surakarta', 250000)
c3 = MhsTIF('Chandra', 'L20019004', 'Surakarta', 235000)
c4 = MhsTIF('Eka', 'L20019006', 'Boyolali', 240000)
c5 = MhsTIF('Fandi', 'L20019005', 'Salatiga', 250000)
c6 = MhsTIF('Deni', 'L20019007', 'Klaten', 245000)
c7 = MhsTIF('Galuh', 'L20019009', 'Wonogiri', 245000)
c8 = MhsTIF('Janto', 'L20019008', 'Klaten', 245000)
c9 = MhsTIF('Hasan', 'L20019011', 'Karanganyar', 270000)
c10 = MhsTIF('Khalid', 'L20019010', 'Purwodadi', 265000)

Daftar=[c0,c1,c2,c3,c4,c5,c6,c7,c8,c9]

###=====MergeSort=====
def mergeSort(A):
    if len(A) > 1:
        mid = len(A) // 2
        separuhkiri = A[:mid]
        separuhkanan = A[mid:]

        mergeSort(separuhkiri)
        mergeSort(separuhkanan)

        i = 0;j=0;k=0
        while i < len(separuhkiri) and j < len(separuhkanan):
```

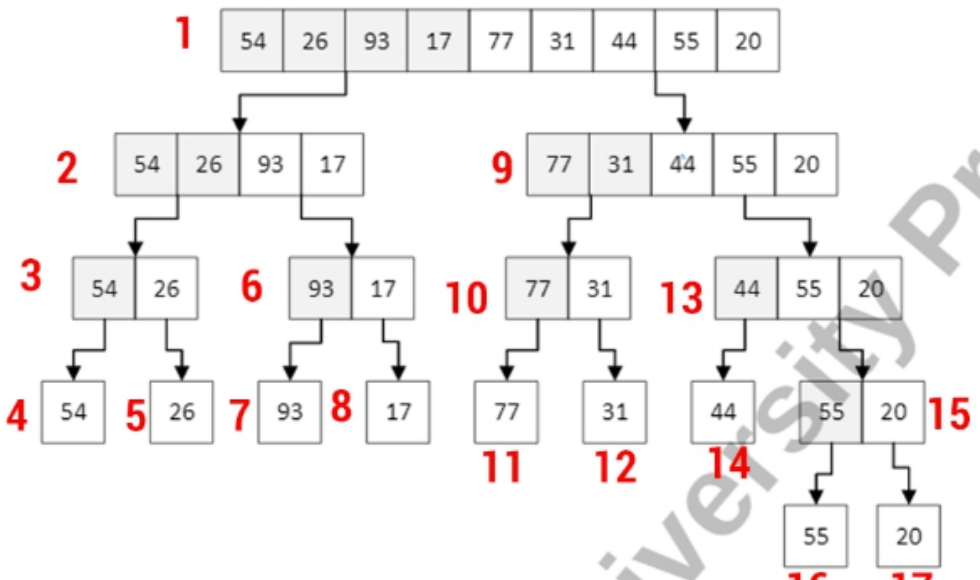
```
            if separuhkiri[i] < separuhkanan[j]:
                A[k] = separuhkiri[i]
                i = i + 1
            else:
                A[k] = separuhkanan[j]
                j = j + 1
            k=k+1

        while i < len(separuhkiri):
            A[k] = separuhkiri[i]
            i = i + 1
            k=k+1

        while j < len(separuhkanan):
            A[k] = separuhkanan[j]
            j = j + 1
            k=k+1

def convert(arr, obj):
    hasil=[]
    for x in range (len(arr)):
        for i in range (len(arr)):
            if arr[x] == obj[i].nim:
                hasil.append(obj[i])
    return hasil

A = []
for x in Daftar:
    A.append(x.nim)

print("=====Merge Sort=====")
mergeSort(A)
for i in convert(A, Daftar):
    print (i.nama,i.nim,i.tinggal,i.us)
print()

###=====QuickSort=====
def partisi(A, awal, akhir):
    nilaipivot = A[awal]

    penandakiri = awal + 1
    penandakanan = akhir

    selesai = False
    while not selesai:

        while penandakiri <= penandakanan and A[penandakiri] <= nilaipivot:
            penandakiri = penandakiri + 1

        while penandakanan >= penandakiri and A[penandakanan] >= nilaipivot:
```

```
            penandakanan = penandakanan - 1

        if penandakanan < penandakiri:
            selesai = True
        else:
            temp = A[penandakiri]
            A[penandakiri] = A[penandakanan]
            A[penandakanan] = temp

    temp = A[awal]
    A[awal] = A[penandakanan]
    A[penandakanan] = temp

    return penandakanan

def quickSortBantu(A, awal, akhir):
    if awal < akhir:
        titikBelah = partisi(A, awal, akhir)
        quickSortBantu(A, awal, titikBelah-1)
        quickSortBantu(A, titikBelah+1, akhir)

def quickSort(A):
    quickSortBantu (A, 0, len(A)-1)

def convert(arr, obj):
    hasil=[]
    for x in range (len(arr)):
        for i in range (len(arr)):
            if arr[x] == obj[i].nim:
                hasil.append(obj[i])
    return hasil

A = []
for x in Daftar:
    A.append(x.nim)

print("=====Quick Sort=====")
quickSort(A)
for i in convert(A, Daftar):
    print (i.nama,i.nim,i.tinggal,i.us)
```

```
= RESTART: D:\Kuliah\Semester 4\Praktikum Algoritma dan Struktur Data\Modul6\Mo
dul6.py
=====Merge Sort=====
Ika L20019001 Sukoharjo 240000
Ahmad L20019002 Surakarta 250000
Budi L20019003 Sragen 230000
Chandra L20019004 Surakarta 235000
Fandi L20019005 Salatiga 250000
Eka L20019006 Boyolali 240000
Deni L20019007 Klaten 245000
Janto L20019008 Klaten 245000
Galuh L20019009 Wonogiri 245000
Hasan L20019011 Karanganyar 270000

=====Quick Sort=====
Ika L20019001 Sukoharjo 240000
Ahmad L20019002 Surakarta 250000
Budi L20019003 Sragen 230000
Chandra L20019004 Surakarta 235000
Fandi L20019005 Salatiga 250000
Eka L20019006 Boyolali 240000
Deni L20019007 Klaten 245000
Janto L20019008 Klaten 245000
Galuh L20019009 Wonogiri 245000
Hasan L20019011 Karanganyar 270000
>>>
```

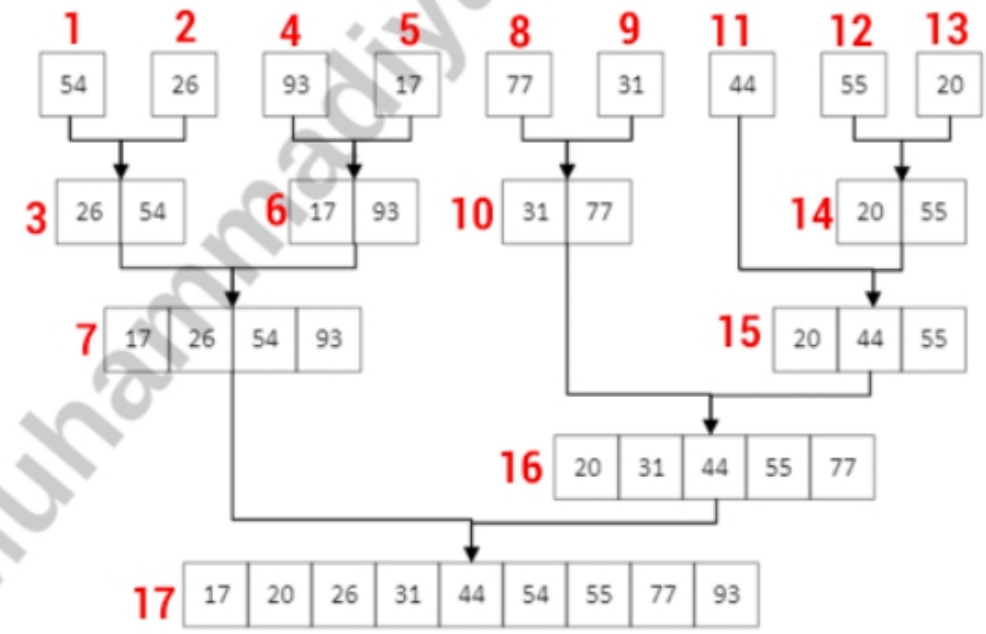
**Nomor 2**

Merge Sort




ambar 6.1: Membelah list sampai tiap sub-list berisi satu elemen atau kosong. Sesudah itu digabung perti ditunjukkan di Gambar 6.2.

Quick Sort




**Gambar** 6.2: Menggabungkan list satu demi satu.

```
#============================================================
#Nomor 3
from time import time as detak
from random import shuffle as kocok
import time

def swap(A, p, q):
    tmp = A[p]
    A[p] = A[q]
    A[q] = tmp

def cariPosisiYangTerkecil(A, dariSini, sampaiSini):
    posisiYangTerkecil = dariSini
    for i in range(dariSini+1, sampaiSini):
        if A[i] < A[posisiYangTerkecil]:
            posisiYangTerkecil = i
    return posisiYangTerkecil

def bubbleSort(S):
    n = len(S)
    for i in range (n-1):
        for j in range (n-i-1):
            if S[j] > S[j+1]:
                swap(S,j,j+1)
    return S

def selectionSort(S):
    n = len(S)
    for i in range(n-1):
        indexKecil = cariPosisiYangTerkecil(S, i, n)
        if indexKecil != i:
            swap(S, i, indexKecil)
    return S

def insertionSort(S):
    n = len(S)
    for i in range(1, n):
        nilai = S[i]
        pos = i
        while pos > 0 and nilai < S[pos -1]:
            S[pos] = S[pos-1]
            pos = pos - 1
        S[pos] = nilai
    return S

def mergeSort(A):
    if len(A) > 1:
        mid = len(A) // 2
        separuhkiri = A[:mid]
```

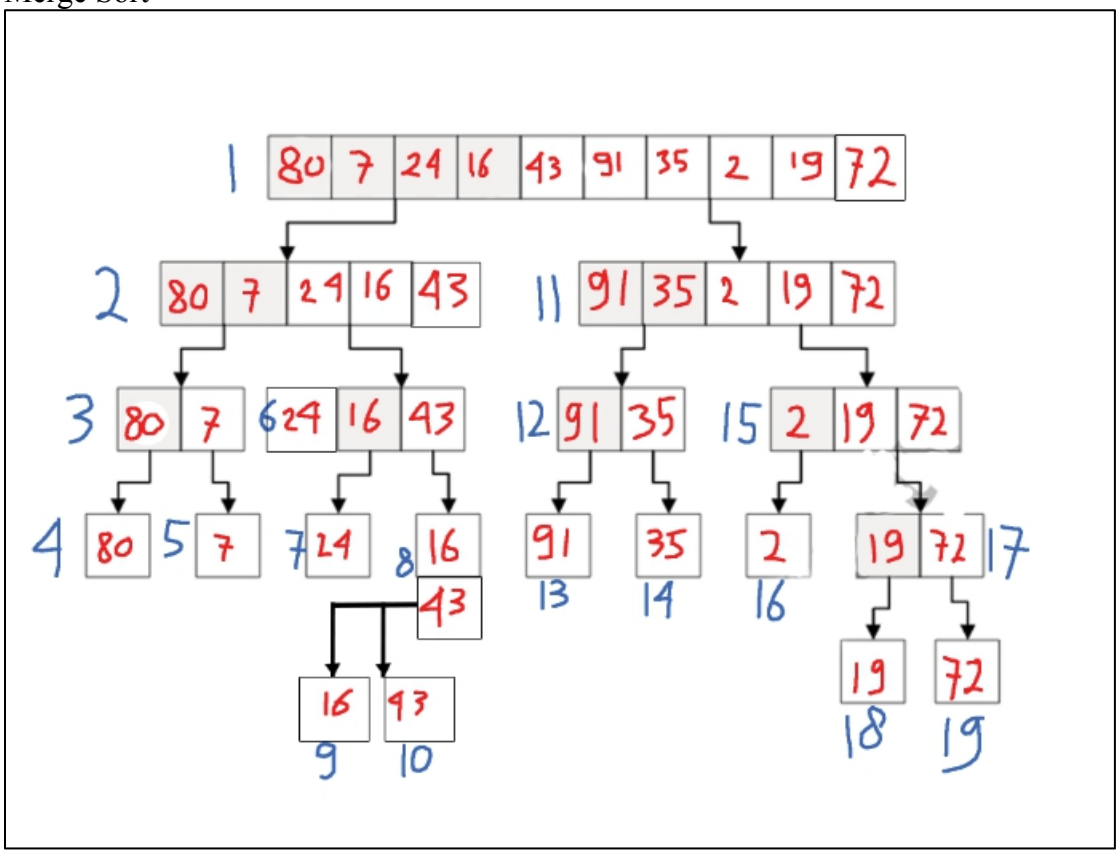
```
        separuhkanan = A[mid:]

        mergeSort(separuhkiri)
        mergeSort(separuhkanan)

        i = 0;j=0;k=0
        while i < len(separuhkiri) and j < len(separuhkanan):
            if separuhkiri[i] < separuhkanan[j]:
                A[k] = separuhkiri[i]
                i = i + 1
            else:
                A[k] = separuhkanan[j]
                j = j + 1
            k=k+1

        while i < len(separuhkiri):
            A[k] = separuhkiri[i]
            i = i + 1
            k=k+1

        while j < len(separuhkanan):
            A[k] = separuhkanan[j]
            j = j + 1
            k=k+1

def partisi(A, awal, akhir):
    nilaipivot = A[awal]

    penandakiri = awal + 1
    penandakanan = akhir

    selesai = False
    while not selesai:

        while penandakiri <= penandakanan and A[penandakiri] <= nilaipivot:
            penandakiri = penandakiri + 1

        while penandakanan >= penandakiri and A[penandakanan] >= nilaipivot:
            penandakanan = penandakanan - 1

        if penandakanan < penandakiri:
            selesai = True
        else:
            temp = A[penandakiri]
            A[penandakiri] = A[penandakanan]
            A[penandakanan] = temp

    temp = A[awal]
    A[awal] = A[penandakanan]
    A[penandakanan] = temp
```

```
    return penandakanan

def quickSortBantu(A, awal, akhir):
    if awal < akhir:
        titikBelah = partisi(A, awal, akhir)
        quickSortBantu(A, awal, titikBelah-1)
        quickSortBantu(A, titikBelah+1, akhir)

def quickSort(A):
    quickSortBantu (A, 0, len(A)-1)


k =  [[i] for i in range(1, 6001)]
kocok(k)
u_bub = k[:]
u_sel = k[:]
u_ins = k[:]
u_mrg = k[:]
u_qck = k[:]

aw=detak();bubbleSort(u_bub);ak=detak();print("bubble: %g detik" %(ak-aw));
aw=detak();selectionSort(u_sel);ak=detak();print("selection: %g detik" %(ak-aw));
aw=detak();insertionSort(u_ins);ak=detak();print("insertion: %g detik" %(ak-aw));
aw=detak();mergeSort(u_mrg);ak=detak();print("merge: %g detik" %(ak-aw));
aw=detak();quickSort(u_qck);ak=detak();print("quick: %g detik" %(ak-aw));
```

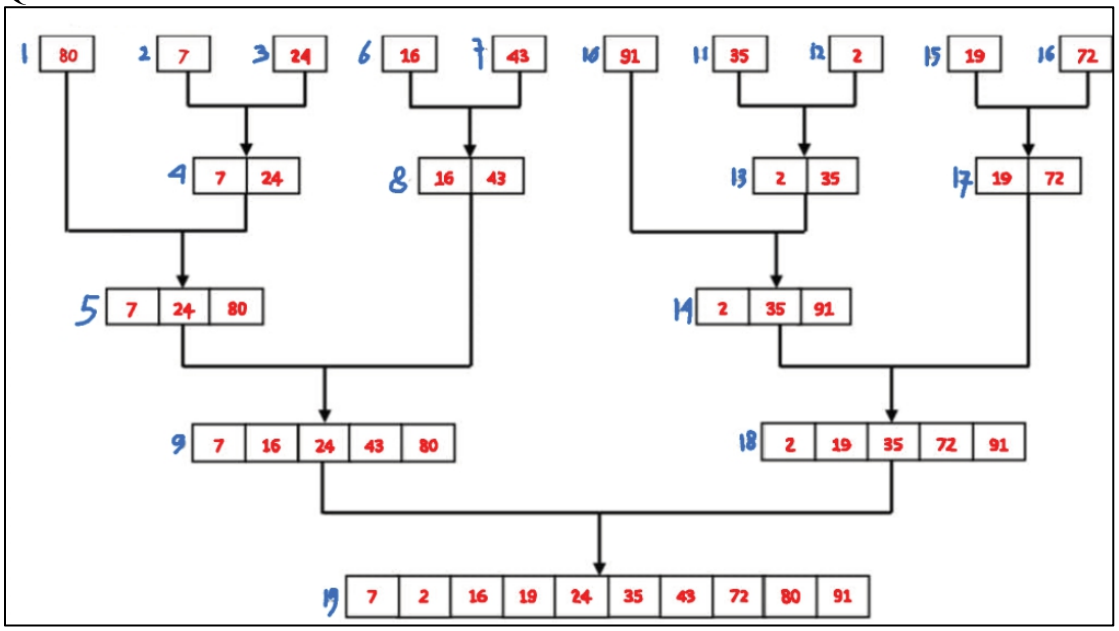
```
= RESTART: D:\Kuliah\Semester 4\Praktikum Algoritma dan Struktur Data\Modul6\Mo
dul6.py
bubble: 10.6266 detik
selection: 4.18724 detik
insertion: 4.53326 detik
merge: 0.0630035 detik
quick: 0.0220013 detik
>>>
```

**Nomor 4**

Merge Sort




Quick Sort



```
#============================================================
#Nomor 5
def mergeSort2(A, awal, akhir):
    mid = (awal+akhir)//2
    if awal < akhir:
        mergeSort2(A, awal, mid)
        mergeSort2(A, mid+1, akhir)

    a, f, l = 0, awal, mid+1
    tmp = [None] * (akhir - awal + 1)
    while f <= mid and l <= akhir:
        if A[f] < A[l]:
            tmp[a] = A[f]
            f += 1
        else:
            tmp[a] = A[l]
            l += 1
        a += 1

    if f <= mid:
        tmp[a:] = A[f:mid+1]

    if l <= akhir:
        tmp[a:] = A[l:akhir+1]

    a = 0
    while awal <= akhir:
        A[awal] = tmp[a]
        awal += 1
        a += 1

def mergeSort(A):
    mergeSort2(A, 0, len(A)-1)

def convert(arr, obj):
    hasil=[]
    for x in range (len(arr)):
        for i in range (len(arr)):
            if arr[x] == obj[i].nim:
                hasil.append(obj[i])
    return hasil

A = []
for x in Daftar:
    A.append(x.nim)
print("MergeSort Urut NIM")
mergeSort(A)
for i in convert(A, Daftar):
    print (i.nama,i.nim,i.tinggal,i.us)
```

```
= RESTART: D:\Kuliah\Semester 4\Praktikum Algoritma dan Struktur Data\Modul6\Mo
dul6.py
MergeSort Urut NIM
Ika L20019001 Sukoharjo 240000
Ahmad L20019002 Surakarta 250000
Budi L20019003 Sragen 230000
Chandra L20019004 Surakarta 235000
Fandi L20019005 Salatiga 250000
Eka L20019006 Boyolali 240000
Deni L20019007 Klaten 245000
Janto L20019008 Klaten 245000
Galuh L20019009 Wonogiri 245000
Hasan L20019011 Karanganyar 270000
>>>
```

#==========

**#Nomor 6**

```
def partisi(A, awal, akhir):
    hasil = 0
    pivot, pidx = median_dari_tiga(A, awal, akhir)
    A[awal], A[pidx] = A[pidx], A[awal]
    i = awal + 1
    for j in range(awal+1, akhir, 1):
        hasil += 1
        if (A[j] < pivot):
            A[i], A[j] = A[j], A[i]
            i += 1
    A[awal], A[i-1] = A[i-1], A[awal]
    return i - 1, hasil

def median_dari_tiga(A, awal, akhir):
    tengah = (awal+akhir-1)//2
    a = A[awal]
    b = A[tengah]
    c = A[akhir-1]
    if a <= b <= c:
        return b, tengah
    if c <= b <= a:
        return b, tengah
    if a <= c <= b:
        return c, akhir-1
    if b <= c <= a:
        return c, akhir-1
    return a, awal

def quickSortBantu(A, awal, akhir):
    hasil = 0
    if awal < akhir:
        titikBelah, hasil = partisi(A, awal, akhir)
        hasil += quickSortBantu(A, awal, titikBelah)
        hasil += quickSortBantu(A, titikBelah + 1, akhir)
    return hasil

def quickSort(A):
```

```
    quickSortBantu(A, 0, len(A))

def convert(arr, obj):
    hasil=[]
    for x in range (len(arr)):
        for i in range (len(arr)):
            if arr[x] == obj[i].nim:
                hasil.append(obj[i])
    return hasil

A = []
for x in Daftar:
    A.append(x.nim)

print("QuickSort Urut NIM")
quickSort(A)
for i in convert(A, Daftar):
  print (i.nama,i.nim,i.tinggal,i.us,)
```

```
= RESTART: D:\Kuliah\Semester 4\Praktikum Algoritma dan Struktur Data\Modul6\Mo
dul6.py
QuickSort Urut NIM
Ika L20019001 Sukoharjo 240000
Ahmad L20019002 Surakarta 250000
Budi L20019003 Sragen 230000
Chandra L20019004 Surakarta 235000
Fandi L20019005 Salatiga 250000
Eka L20019006 Boyolali 240000
Deni L20019007 Klaten 245000
Janto L20019008 Klaten 245000
Galuh L20019009 Wonogiri 245000
Hasan L20019011 Karanganyar 270000
>>>
```

```
  #============================================================
  #Nomor 7
  from time import time as detak
  from random import shuffle as kocok
  import time

  def mergeSort(A):
      #print("Membelah      ",A)
      if len(A) > 1:
          mid = len(A) // 2
          separuhkiri = A[:mid]
          separuhkanan = A[mid:]

          mergeSort(separuhkiri)
          mergeSort(separuhkanan)

          i = 0;j=0;k=0
          while i < len(separuhkiri) and j < len(separuhkanan):
              if separuhkiri[i] < separuhkanan[j]:
```

```
            A[k] = separuhkiri[i]
            i = i + 1
        else:
            A[k] = separuhkanan[j]
            j = j + 1
        k=k+1

    while i < len(separuhkiri):
        A[k] = separuhkiri[i]
        i = i + 1
        k=k+1

    while j < len(separuhkanan):
        A[k] = separuhkanan[j]
        j = j + 1
        k=k+1
  #print("Menggabungkan",A)

def partisi(A, awal, akhir):
  nilaipivot = A[awal]

  penandakiri = awal + 1
  penandakanan = akhir

  selesai = False
  while not selesai:

    while penandakiri <= penandakanan and A[penandakiri] <= nilaipivot:
      penandakiri = penandakiri + 1

    while penandakanan >= penandakiri and A[penandakanan] >= nilaipivot:
      penandakanan = penandakanan - 1

    if penandakanan < penandakiri:
      selesai = True
    else:
      temp = A[penandakiri]
      A[penandakiri] = A[penandakanan]
      A[penandakanan] = temp

  temp = A[awal]
  A[awal] = A[penandakanan]
  A[penandakanan] = temp

  return penandakanan

def quickSortBantu(A, awal, akhir):
  if awal < akhir:
    titikBelah = partisi(A, awal, akhir)
    quickSortBantu(A, awal, titikBelah-1)
```

```
        quickSortBantu(A, titikBelah+1, akhir)

def quickSort(A):
    quickSortBantu (A, 0, len(A)-1)

def mergeSort2(A, awal, akhir):
    mid = (awal+akhir)//2
    if awal < akhir:
        mergeSort2(A, awal, mid)
        mergeSort2(A, mid+1, akhir)

    a, f, l = 0, awal, mid+1
    tmp = [None] * (akhir - awal + 1)
    while f <= mid and l <= akhir:
        if A[f] < A[l]:
            tmp[a] = A[f]
            f += 1
        else:
            tmp[a] = A[l]
            l += 1
        a += 1

    if f <= mid:
        tmp[a:] = A[f:mid+1]

    if l <= akhir:
        tmp[a:] = A[l:akhir+1]

    a = 0
    while awal <= akhir:
        A[awal] = tmp[a]
        awal += 1
        a += 1

def mergeSortNew(A):
    mergeSort2(A, 0, len(A)-1)

def quickSortNew(arr):
    kurang = []
    pivotList = []
    lebih = []
    if len(arr) <= 1:
        return arr
    else:
        pivot = arr[0]
        for i in arr:
            if i < pivot:
                kurang.append(i)
            elif i > pivot:
                lebih.append(i)
```

```
            else:
                pivotList.append(i)
        kurang = quickSortNew(kurang)
        lebih = quickSortNew(lebih)
        return kurang + pivotList + lebih

daftar = [10, 51, 2, 18, 4, 31, 13, 5, 23, 64, 29]
print (daftar)
mergeSort(daftar)
quickSort(daftar)
mergeSortNew(daftar)
quickSortNew(daftar)

k =  [[i] for i in range(1, 6001)]
kocok(k)
u_mrg = k[:]
u_qck = k[:]
u_mrgNew = k[:]
u_qckNew = k[:]

aw=detak();mergeSort(u_mrg);ak=detak();print("Merge v.1: %g detik" %(ak-aw));
aw=detak();quickSort(u_qck);ak=detak();print("Quick v.1: %g detik" %(ak-aw));
aw=detak();mergeSortNew(u_mrgNew);ak=detak();print("Merge v.2: %g
detik" %(ak-aw));
aw=detak();quickSortNew(u_qckNew);ak=detak();print("Quick v.2: %g
detik" %(ak-aw));
```

```
= RESTART: D:\Kuliah\Semester 4\Praktikum Algoritma dan Struktur Data\Modul6\Mo
dul6.py
[10, 51, 2, 18, 4, 31, 13, 5, 23, 64, 29]
Merge v.1: 0.0400023 detik
Quick v.1: 0.0240016 detik
Merge v.2: 0.051003 detik
Quick v.2: 0.0430026 detik
>>>
```

```
#============================================================
```

**#Nomor 8**

```
class Node():
    def __init__(self, data, tautan=None):
        self.data = data
        self.tautan = tautan

def cetak(head):
    curr = head
    while curr is not None:
        try:
            print (curr.data)
            curr = curr.tautan
        except:
            pass
```

```
a = Node(80)
b = Node(7)
c = Node(24)
d = Node(16)
e = Node(43)
f = Node(91)
g = Node(35)
h = Node(2)
i = Node(19)
j = Node(72)

a.tautan = b
b.tautan = c
c.tautan = d
d.tautan = e
e.tautan = f
f.tautan = g
g.tautan = h
h.tautan = i
i.tautan = j
def mergeSortLinkedList(A):
    linked = A
    try:
        daftar = []
        curr = A
        while curr:
            daftar.append(curr.data)
            curr = curr.tautan
        A = daftar
    except:
        A = A

    if len(A) > 1:
        mid = len(A) // 2
        separuhkiri = A[:mid]
        separuhkanan = A[mid:]

        mergeSortLinkedList(separuhkiri)
        mergeSortLinkedList(separuhkanan)

        i = 0;j=0;k=0
        while i < len(separuhkiri) and j < len(separuhkanan):
            if separuhkiri[i] < separuhkanan[j]:
                A[k] = separuhkiri[i]
                i = i + 1
            else:
                A[k] = separuhkanan[j]
                j = j + 1
            k=k+1
```

```
        while i < len(separuhkiri):
            A[k] = separuhkiri[i]
            i = i + 1
            k=k+1

        while j < len(separuhkanan):
            A[k] = separuhkanan[j]
            j = j + 1
            k=k+1

    for x in A:
        try:
            linked.data = x
            linked = linked.tautan
        except:
            pass

mergeSortLinkedList(a)
cetak(a)
```

```
= RESTART: D:\Kuliah\Semester 4\Praktikum Algoritma dan Struktur Data\Modul6\Mo
dul6.py
2
7
16
19
24
35
43
72
80
91
>>>
```