

MODUL 3

MEDIUM

Naufal is an informatics student who is developing a hospital management system to assist in the administrative processes of doctors and patients. In the system he has created, each doctor and patient has their own complete data. Each doctor has several patients with the following initial data:

The patient data recorded includes Patient ID, Patient Name, Age, Systolic Blood Pressure, and Diastolic Blood Pressure. Meanwhile, the doctor data recorded includes: Doctor ID, Doctor Name, Specialization, and Work Experience (in years).

After the data is entered, Naufal wants to ensure that all information is correct. So, he displays the entire list of doctors and patients registered in the system.

===== Menampilkan Seluruh Data Dokter dan Pasien =====

Doctor ID : 1

Doctor : Dr. Michael Harris

Specialization: Cardiology

Experience : 12 years

Patient List:

| ID | Patient Name | Age | Systolic | Diastolic |
|----|----------------|-----|----------|-----------|
| 1 | Daniel Carter | 20 | 110 | 75 |
| 2 | Alicia Morgan | 45 | 135 | 85 |
| 3 | Ryan Mitchell | 33 | 125 | 80 |
| 4 | Natalie Brooks | 55 | 145 | 95 |
| 5 | Brandon Cooper | 28 | 118 | 78 |
| 6 | Laura Walker | 60 | 160 | 100 |
| 7 | Jonathan Reed | 39 | 130 | 84 |
| 8 | Emily Parker | 26 | 119 | 77 |
| 9 | Christian Hall | 52 | 148 | 96 |
| 10 | Victoria Adams | 47 | 140 | 92 |
| 11 | Samuel Morris | 31 | 123 | 81 |
| 12 | Olivia Turner | 29 | 116 | 76 |
| 13 | Andrew Scott | 58 | 155 | 99 |
| 14 | Grace Phillips | 42 | 133 | 87 |
| 15 | Dylan Hughes | 36 | 127 | 82 |

Doctor ID : 2

Doctor : Dr. Emily Parker

Specialization: Neurology

Experience : 15 years

Patient List:

| ID | Patient Name | Age | Systolic | Diastolic |
|----|----------------|-----|----------|-----------|
| 1 | Ethan Sullivan | 37 | 128 | 82 |
| 2 | Chloe Ramirez | 50 | 142 | 94 |
| 3 | Marcus Turner | 29 | 117 | 76 |
| 4 | Sophie Turner | 61 | 155 | 98 |
| 5 | Liam Anderson | 46 | 138 | 90 |
| 6 | Isabella Moore | 33 | 125 | 83 |
| 7 | Jason Bennett | 41 | 131 | 86 |
| 8 | Madison Clark | 27 | 118 | 77 |
| 9 | George Ramirez | 54 | 150 | 97 |
| 10 | Sophia Grant | 44 | 139 | 91 |
| 11 | Patrick Carter | 35 | 126 | 82 |
| 12 | Abigail Foster | 30 | 120 | 79 |
| 13 | Nicholas Hayes | 59 | 156 | 101 |
| 14 | Ella Simmons | 43 | 134 | 88 |
| 15 | Lucas Griffin | 38 | 129 | 84 |

Doctor ID : 3

Doctor : Dr. Jonathan Reed

Specialization: Orthopedics

Experience : 20 years

Patient List:

| ID | Patient Name | Age | Systolic | Diastolic |
|----|----------------|-----|----------|-----------|
| 1 | Oliver Foster | 42 | 132 | 88 |
| 2 | Hannah Price | 34 | 120 | 79 |
| 3 | William Scott | 58 | 150 | 92 |
| 4 | Amelia Collins | 41 | 134 | 88 |
| 5 | Henry Walton | 63 | 159 | 101 |
| 6 | Mia Thompson | 27 | 115 | 75 |
| 7 | Joshua Morgan | 39 | 129 | 83 |
| 8 | Charlotte Gray | 32 | 118 | 78 |
| 9 | Anthony Rivera | 55 | 147 | 95 |
| 10 | Natalie Hughes | 46 | 136 | 89 |
| 11 | Christian Bell | 30 | 122 | 81 |
| 12 | Amelia Barnes | 28 | 117 | 76 |
| 13 | Sebastian Gray | 60 | 158 | 100 |
| 14 | Lilian Cooper | 40 | 133 | 87 |
| 15 | Jackson Perez | 35 | 126 | 82 |

One day, Dr. Michael Harris wanted to find a patient aged 45. Naufal used Linear Search to find the patient, then recorded the execution time using System.nanoTime().

```
=====
Mencari pasien dari Dr. Michael Harris yang berumur 45 tahun dengan Linear Search
=====
Patient found for doctor Dr. Michael Harris
ID      : 2
Name    : Alicia Morgan
Age     : 45
Systolic : 135
Diastolic: 85

Waktu eksekusi: 0,00301770 detik
```

Shortly thereafter, Dr. Emily Parker also wanted to find a patient aged 61. This time, Naufal used Binary Search to perform the search.

```
=====
Mencari pasien dari Dr. Emily Parker yang berumur 61 tahun dengan Binary Search
=====
Patient found for doctor Dr. Emily Parker
ID      : 15
Name    : Sophie Turner
Age     : 61
Systolic : 155
Diastolic: 98

Waktu eksekusi: 0,00234730 detik
```

One day, Dr. Jonathan Reed requested the data of a patient named “Sebastian Gray” for further examination. Naufal searched the doctor's patient list using the Linear Search method, then recorded the search time.

```
=====
Mencari pasien dari Dr. Jonathan Reed yang bernama Sebastian Gray dengan Linear Search
=====
Patient found for doctor Dr. Jonathan Reed
ID      : 13
Name    : Sebastian Gray
Age     : 60
Systolic : 158
Diastolic: 100

Waktu eksekusi: 0,00397200 detik
```

A few moments later, the administration department requested the patient data of “Daniel Carter” from Dr. Michael Harris’s patient list. For this search, Naufal used the Binary Search method.

```
=====
Mencari pasien dari Dr. Michael Harris yang bernama Daniel Carter dengan Binary Search
=====
Patient found for doctor Dr. Michael Harris
ID      : 5
Name    : Daniel Carter
Age     : 20
Systolic : 110
Diastolic: 75

Waktu eksekusi: 0,00297410 detik
```

After conducting the search, Naufal moved on to sorting the patient data to make administration easier. First, he sorted Dr. Michael Harris's patients by name using the Selection Sort method.

```
=====
Mengurutkan pasien dari Dr. Michael Harris berdasarkan Nama dengan Selection Sort
=====
Doctor Dr. Michael Harris's patients have been successfully sorted by name (ascending) - Selection Sort
ID    Patient Name    Age    Systolic    Diastolic
1     Alicia Morgan     45     135         85
2     Andrew Scott      58     155         99
3     Brandon Cooper    28     118         78
4     Christian Hall     52     148         96
5     Daniel Carter     20     110         75
6     Dylan Hughes      36     127         82
7     Emily Parker      26     119         77
8     Grace Phillips    42     133         87
9     Jonathan Reed     39     130         84
10    Laura Walker      60     160         100
11    Natalie Brooks   55     145         95
12    Olivia Turner    29     116         76
13    Ryan Mitchell    33     125         80
14    Samuel Morris    31     123         81
15    Victoria Adams   47     140         92
-----
Waktu eksekusi: 0,00456890 detik
```

To support efficient administration, Dr. Emily Parker's patient list also needed to be sorted by name. Naufal sorted the doctor's patient data using the Insertion Sort method.

```
=====
Mengurutkan pasien dari Dr. Emily Parker berdasarkan nama dengan Insertion Sort
=====
Doctor Dr. Emily Parker's patients have been successfully sorted by name (ascending) - Insertion Sort
ID    Patient Name    Age    Systolic    Diastolic
1     Abigail Foster   30     120         79
2     Chloe Ramirez    50     142         94
3     Ella Simmons     43     134         88
4     Ethan Sullivan   37     128         82
5     George Ramirez   54     150         97
6     Isabella Moore   33     125         83
7     Jason Bennett    41     131         86
8     Liam Anderson   46     138         90
9     Lucas Griffin    38     129         84
10    Madison Clark    27     118         77
11    Marcus Turner   29     117         76
12    Nicholas Hayes   59     156         101
13    Patrick Carter   35     126         82
14    Sophia Grant    44     139         91
15    Sophie Turner    61     155         98
-----
Waktu eksekusi: 0,00065140 detik
```

To make it easier for doctors to monitor patient conditions, Naufal also sorted patients based on blood pressure. He began by sorting Dr. Jonathan Reed's patients based on systolic pressure using Selection Sort.

```
=====
Mengurutkan pasien dari Dr. Jonathan Reed berdasarkan tekanan systolic dengan Selection Sort
=====
Doctor Dr. Jonathan Reed's patients have been successfully sorted by systolic (ascending) - Selection Sort
ID    Patient Name    Age    Systolic    Diastolic
1     Mia Thompson     27     115         75
2     Amelia Barnes    28     117         76
3     Charlotte Gray   32     118         78
4     Hannah Price     34     120         79
5     Christian Bell   30     122         81
6     Jackson Perez    35     126         82
7     Joshua Morgan    39     129         83
8     Oliver Foster    42     132         88
9     Lilian Cooper    40     133         87
10    Amelia Collins   41     134         88
11    Natalie Hughes   46     136         89
12    Anthony Rivera   55     147         95
13    William Scott    58     150         92
14    Sebastian Gray   60     158         100
15    Henry Walton     63     159         101
-----
Waktu eksekusi: 0,00061470 detik
```

After that, Dr. Michael Harris's patient list was also sorted by systolic pressure to facilitate monitoring of patient conditions. The sorting process was performed using the Insertion Sort.

```
=====
Mengurutkan pasien dari Dr. Michael Harris berdasarkan tekanan sistolic dengan Insertion Sort
=====
Doctor Dr. Michael Harris's patients have been successfully sorted by systolic (ascending) - Insertion Sort
ID      Patient Name   Age   Systolic   Diastolic
1       Daniel Carter   20    110        75
2       Olivia Turner    29    116        76
3       Brandon Cooper   28    118        78
4       Emily Parker      26    119        77
5       Samuel Morris    31    123        81
6       Ryan Mitchell    33    125        80
7       Dylan Hughes     36    127        82
8       Jonathan Reed    39    130        84
9       Grace Phillips   42    133        87
10      Alicia Morgan     45    135        85
11      Victoria Adams   47    140        92
12      Natalie Brooks   55    145        95
13      Christian Hall   52    148        96
14      Andrew Scott     58    155        99
15      Laura Walker     60    160        100
=====
Waktu eksekusi: 0,00055170 detik
```

Notes:

- To calculate the search and sort time, you can use the following code or another algorithm:

```
long startTime = System.nanoTime();
//The sorting or searching algorithm method used
long endTime = System.nanoTime();
double waktu = (double) (endTime - startTime) / 1000000000.0;
System.out.printf(format:"Waktu eksekusi: %.8f detik\n", waktu);
```

Aturan:

- Use a nested linked list for the list of doctors and their patients.
- Use the selection sort and insertion sort methods.
- Use the linear search and binary search methods.
- Perform sorting and searching on the data and compare the time effectiveness of each sorting and searching. (The data compared is 100 data, 200 data and 300 data).
- For comparison, add data and perform the comparison only for patients of Dr. Michael Harris.
- Example of comparison results

| Number of Data | Linear Searching | Binary Searching | Selection Sorting | Insertion Sorting |
|----------------|------------------|------------------|-------------------|-------------------|
| 100 | waktu | waktu | waktu | waktu |
| 200 | waktu | waktu | waktu | waktu |
| 300 | waktu | waktu | waktu | waktu |

- Try to use data that is still random.
- Analyze the results of the sorting and searching that has been done, compare the results of each sorting and searching algorithm. Which algorithm is the most effective and efficient according to the available data for each sorting and searching.