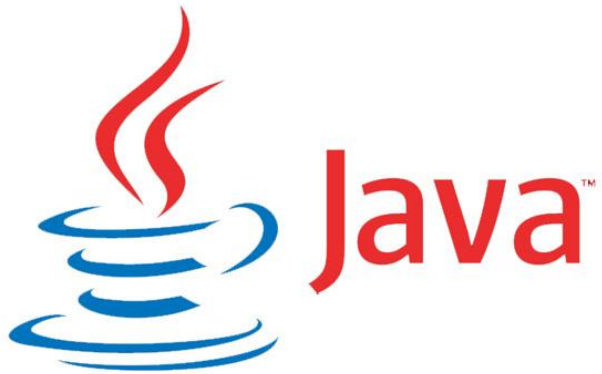
Edisi 2022

Pengantar Pemrograman dengan Bahasa Java

IF2123 Aljabar Geometri

Oleh: Rinaldi Munir



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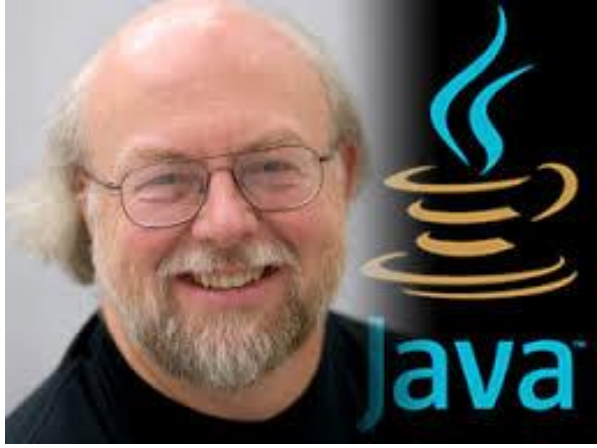
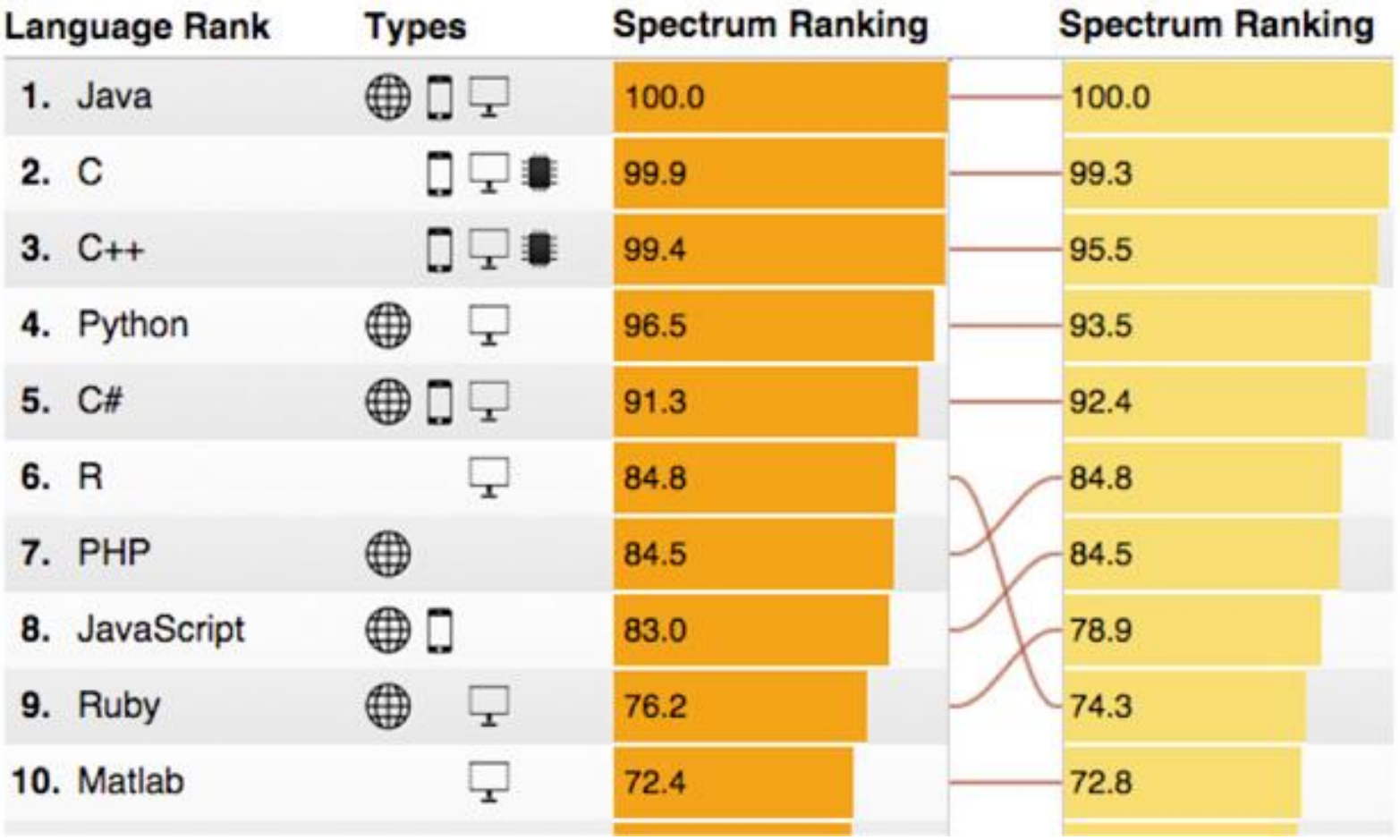
Sejarah Bahasa Java



James Gosling

- Bahasa java dibuat oleh James Gosling saat masih bergabung di *Sun Microsystems* dan dirilis tahun 1995.
- Bahasa Java dapat dijalankan pada berbagai komputer dan *platform* sistem operasi.
- Slogan Java: *Write once, run anywhere!* (Tulis sekali, jalankan di manapun)
- Java adalah bahasa pemrograman bersifat umum (*general purpose*)
- Sintaks Bahasa Java diadopsi dari Bahasa C dan C++ tetapi lebih sederhana
- Nama “java” diambil dari jenis kopi yang diminum oleh James Gosling saat itu.

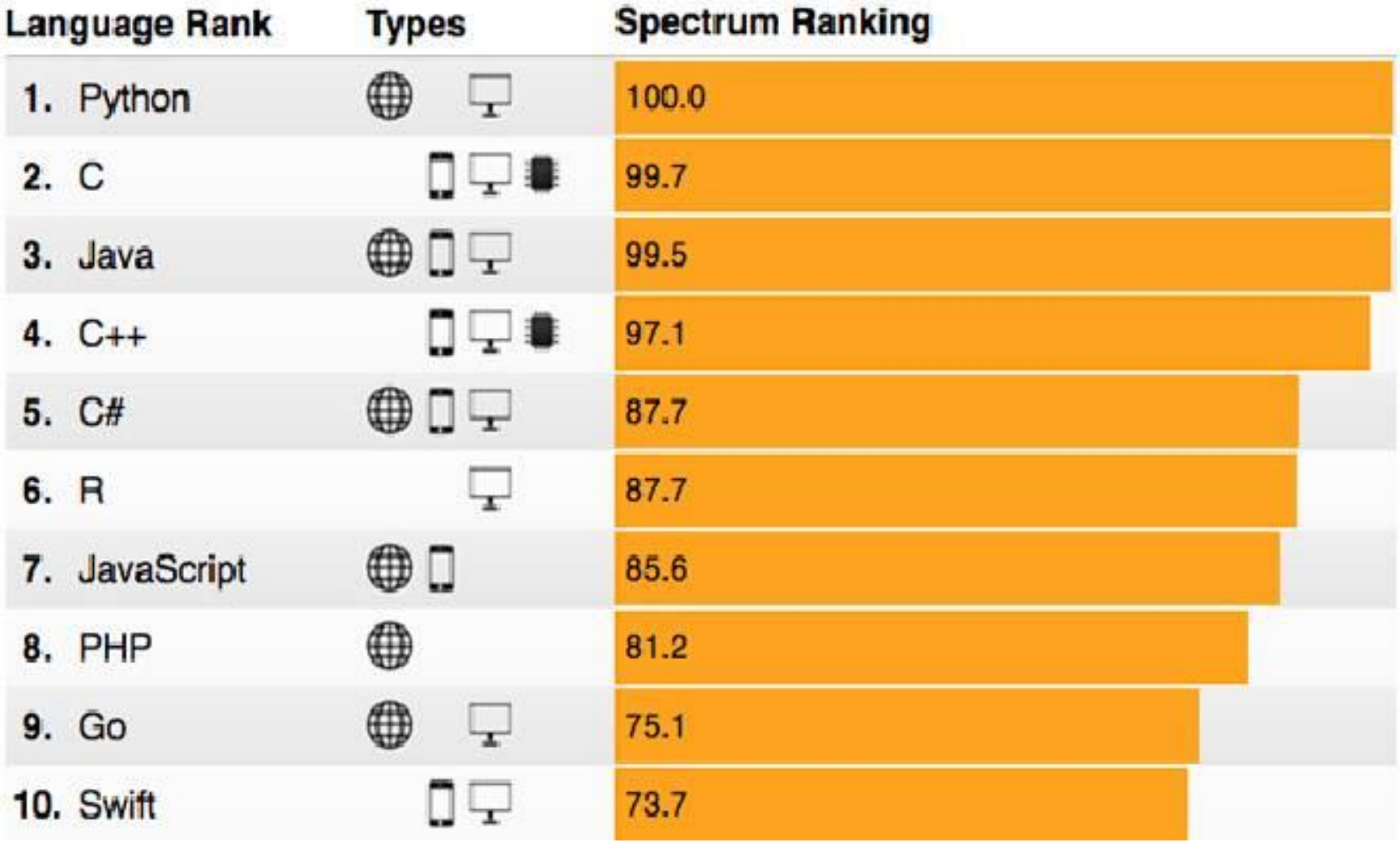
- Java termasuk Bahasa pemrograman yang popular untuk mengembangkan aplikasi, termasuk aplikasi berbasis web.



Gambar 1. Sepuluh (10) bahasa pemrograman top 2015:

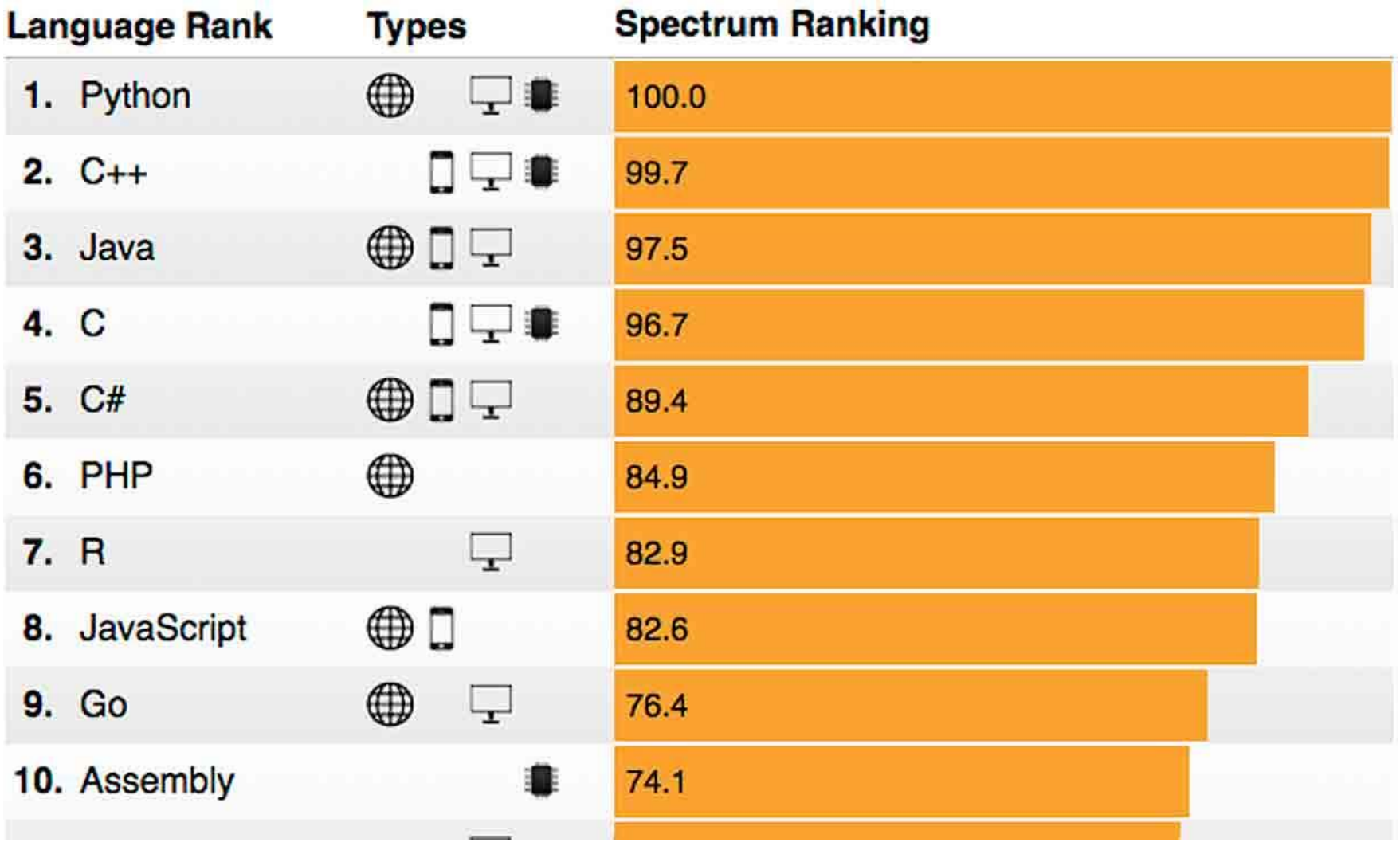
Sumber: http://spectrum.ieee.org/computing/software/the-2015-top-ten-programming-languages/?utm_source=techalert&utm_medium=email&utm_campaign=072315

- Pada tahun 2017, Bahasa Java turun ke peringkat 3



Gambar 2. Sepuluh (10) bahasa pemrograman top 2017

- 2018



Gambar 3. Sepuluh (10) bahasa pemrograman top 2018

2019

IEEE Ranked the Top Programming Languages of 2019.

Rank	Language	Type	Score
1	Python		100.0
2	Java		96.3
3	C		94.4
4	C++		87.5
5	R		81.5
6	JavaScript		79.4
7	C#		74.5
8	Matlab		70.6
9	Swift		69.1
10	Go		68.0

Sumber:
https://learnworthy.net/ieee-ranked-the-top-programming-languages-of-2019/

2020

IEEE Ranked the Top Programming Languages of 2020

Rank	Language	Type	Score
1	Python		100.0
2	Java		95.3
3	C		94.6
4	C++		87.0
5	JavaScript		79.5
6	R		78.6
7	Arduino		73.2
8	Go		73.1
9	Swift		70.5
10	Matlab		68.4

2021

IEEE Ranked the Top Programming Languages of 2020

Rank	Language	Type	Score
1	Python		100.0
2	Java		95.4
3	C		94.7
4	C++		92.4
5	JavaScript		88.1
6	C#		82.4
7	R		81.7
8	Go		77.7
9	HTML		75.4
10	Swift		70.4

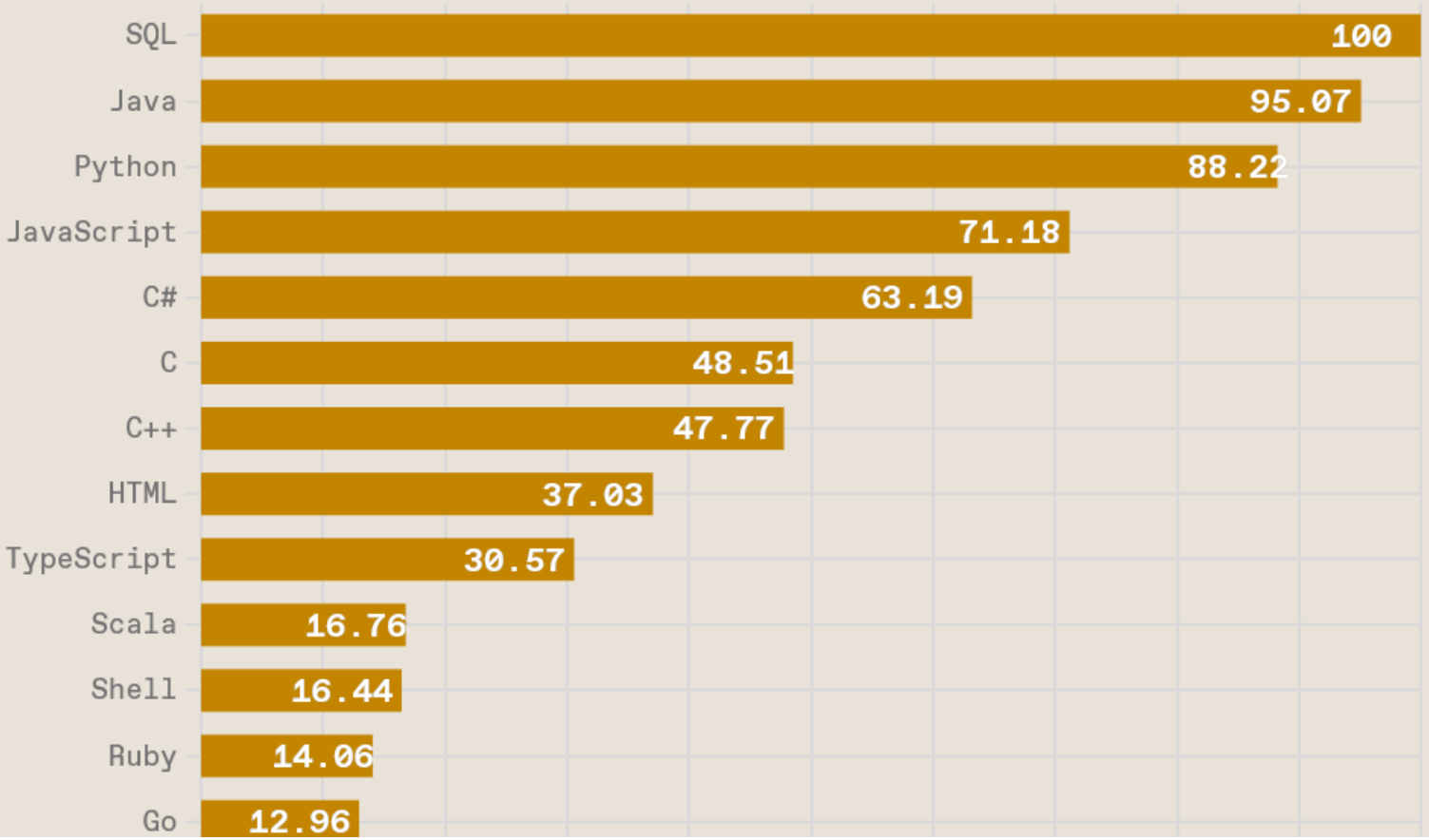
Sumber: https://spectrum.ieee.org/top-programming-languages-2021

https://spectrum.ieee.org/top-programming-languages-2022

Top Programming Languages 2022

Click a button to see a differently weighted ranking

Spectrum | **Jobs** | Trending

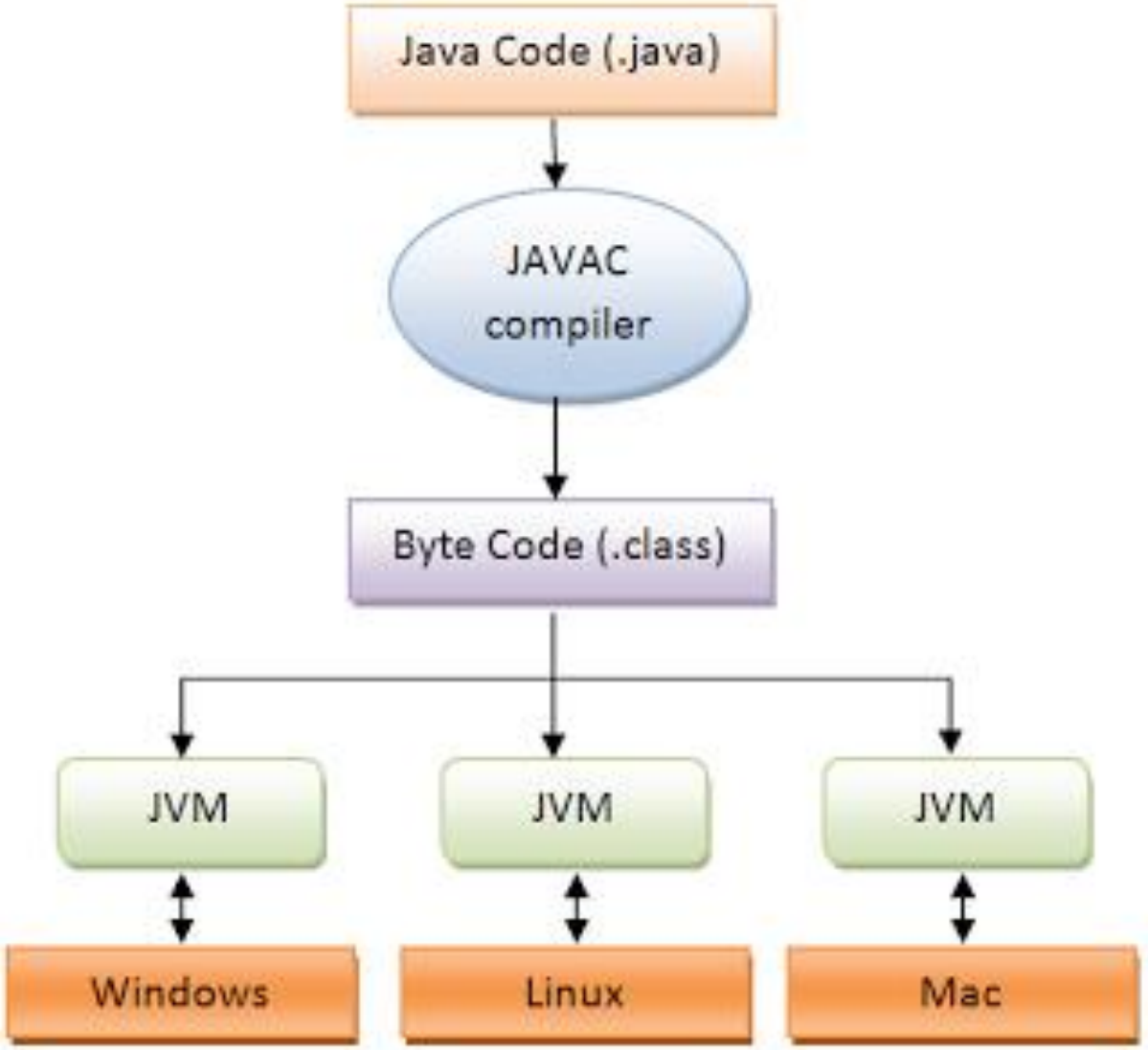


Teknologi Java = Bahasa pemrograman + platform

Java Sebagai Bahasa Pemrograman

- Bahasa java memiliki karakteristik: *sederhana*, *berorientasi objek*, *interpreted*, *terdistribusi*, *tangguh*, *portable*, *memiliki kinerja tinggi*, *aman*, *dinamis.* (Baca di: http://java.sun.com/docs/white/langenv/)

- *Compiler* java mengubah kode program menjadi bahasa *intermediate* yang disebut *java bytecode*. Kemudian *interpreter* Java bernama JVM (*Java Virtual Machine*) melakukan interpretasi *bytecode* setiap kali *bytecode* tersebut dijalankan.



Gambar 2. Proses kompilasi dan interpretasi program Java
(Sumber gambar: http://belajarjava-19.blogspot.co.id)

Java Sebagai Sebuah *Platform*

- *Platform* adalah lingkungan perangkat keras dan perangkat lunak untuk menjalankan program.
- Java adalah *platform* perangkat lunak untuk menjalankan program java.
- *Paltform* java terdiri dari dua komponen:
    1. *Java Virtual Machine* (JVM)
    2. *Java Application Programmming Interface* (Java API)

- JVM pada dasarnya adalah aplikasi sederhana yang ditulis dalam bahasa C untuk mengeksekusi program yang ditulis dalam bahasa Java.

- Cara kerja JVM: Pada saat eksekusi, JVM membaca *bytecode*, lalu mengubahnya ke bahasa mesin yang sesuai dengan komputer yang menjalankannya.

- Proses kompilasi bahasa java menghasilkan *bytecode* yang selalu sama untuk setiap sistem operasi atau jenis mesinnya, tetapi JVM akan mengubah *byetecode* menjadi bahasa mesin tujuannya.

- Java API merupakan *library* yang disediakan java untuk mengembangkan program java. Java API berisi sekumpulan komponen perangkat lunak yang memudahkan pemrogram java mengembangkan aplikasi.

Kakas Java

Untuk menulis program java, diperlukan beberapa kakas:

1. *Java Development Kit (JDK)*

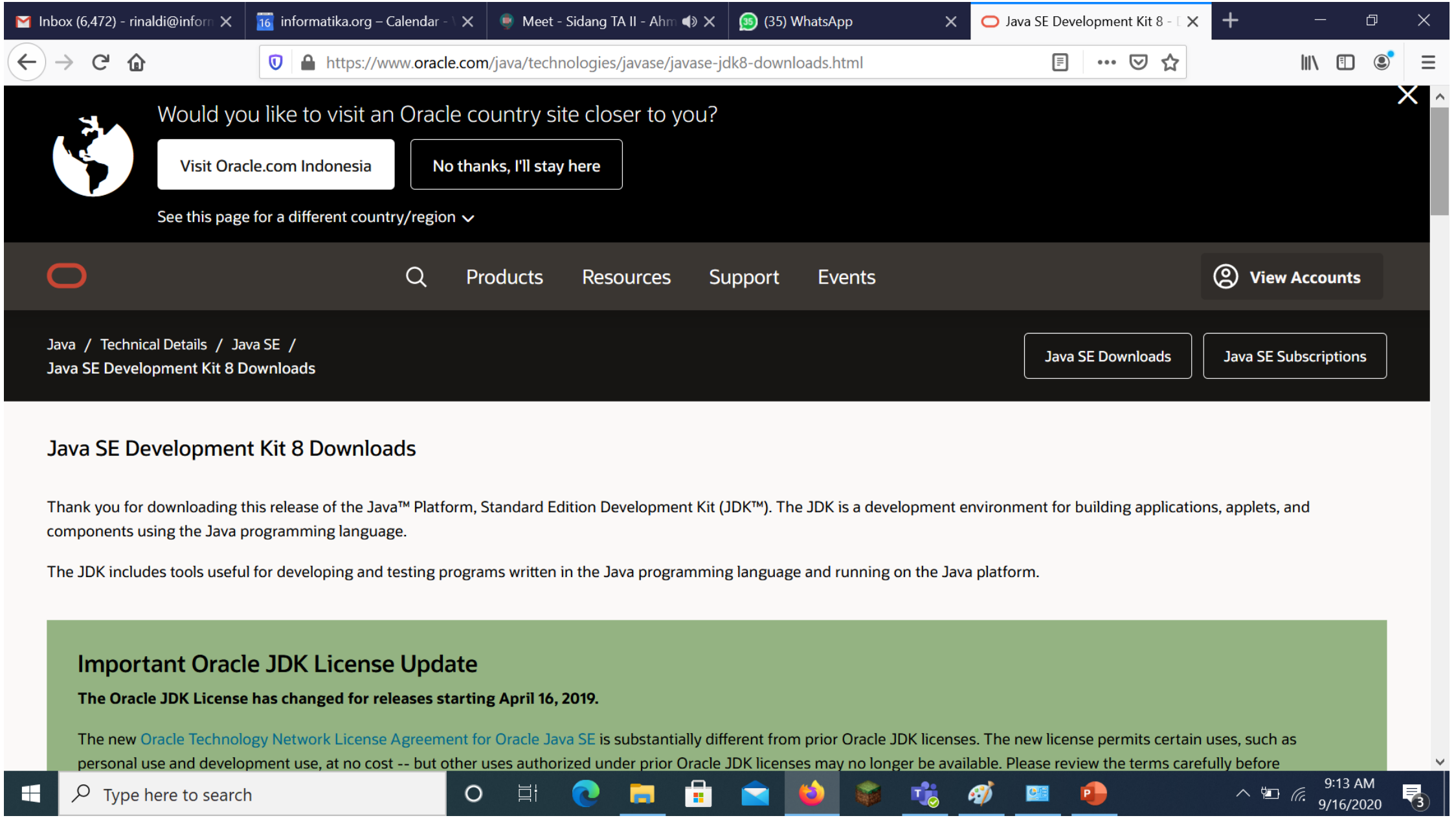
   Unduh paket JDK (*Java Development Kit*) java terbaru dari situs:

   https://www.oracle.com/java/technologies/javase/javase-jdk8-downloads.html

   atau https://www.java.com/en/download/

2. Editor teks

   Sembarang editor teks seperti *Notepad*, *Ultraedit*, *Wordpad*, *Vi*, atau *Joe*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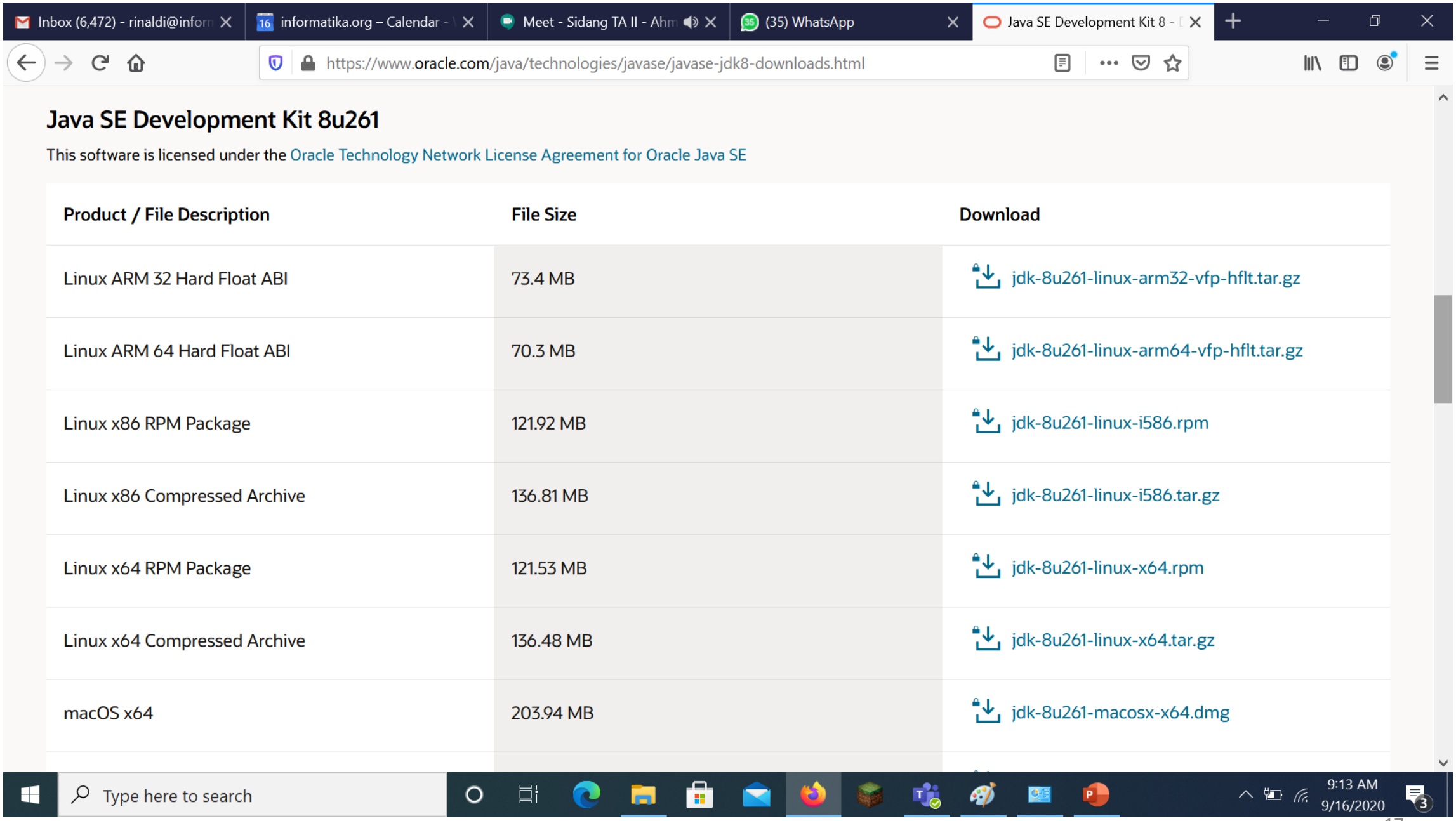
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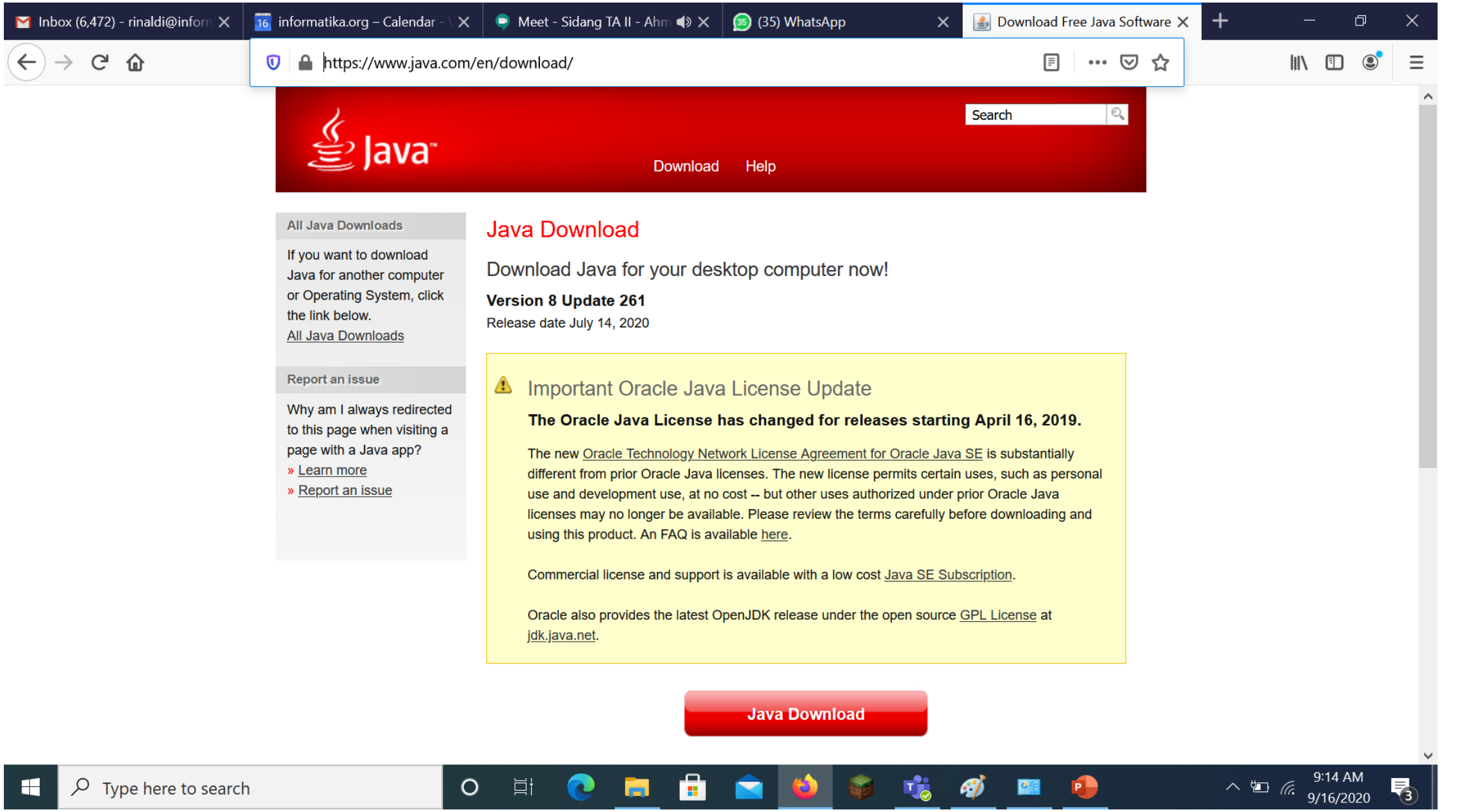
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Release date July 14, 2020
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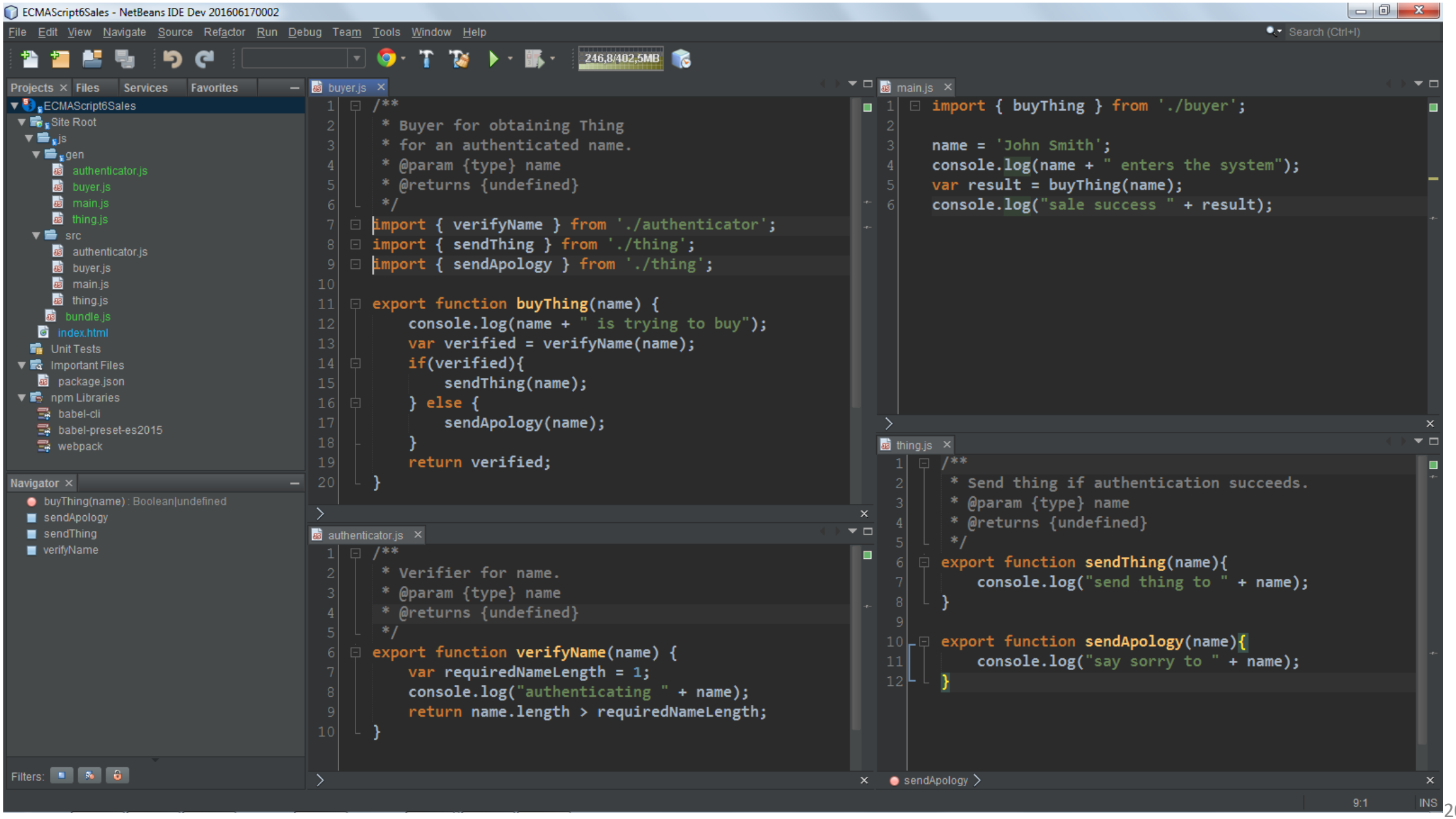
- Untuk pengembangan aplikasi visual (*visual programming*), anda membutuhkan kakas pengembangan java yang mengintegrasikan:
    - JDK
    - Editor teks
    - Editor antarmuka pengguna (GUI = *Graphical User Interface*)
    - Manajemen aplikasi
    - *Debugger*

- Contoh kakas pengembangan java: *Netbeans* dan *Eclipse*

Netbeans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index.html
Unit Tests
Important Files
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npm Libraries
babel-cli
babel-preset-es2015
webpack
Navigator
buyThing(name) : Boolean|undefined
sendApology
sendThing
verifyName
Filters:
buyer.js
/**
* Buyer for obtaining Thing
* for an authenticated name.
* @param {type} name
* @returns {undefined}
*/
import { verifyName } from './authenticator';
import { sendThing } from './thing';
import { sendApology } from './thing';
export function buyThing(name) {
console.log(name + " is trying to buy");
var verified = verifyName(name);
if(verified){
sendThing(name);
} else {
sendApology(name);
}
return verified;
}
main.js
import { buyThing } from './buyer';
name = 'John Smith';
console.log(name + " enters the system");
var result = buyThing(name);
console.log("sale success " + result);
authenticator.js
/**
* Verifier for name.
* @param {type} name
* @returns {undefined}
*/
export function verifyName(name) {
var requiredNameLength = 1;
console.log("authenticating " + name);
return name.length > requiredNameLength;
}
thing.js
/**
* Send thing if authentication succeeds.
* @param {type} name
* @returns {undefined}
*/
export function sendThing(name){
console.log("send thing to " + name);
}
export function sendApology(name){
console.log("say sorry to " + name);
}
sendApology
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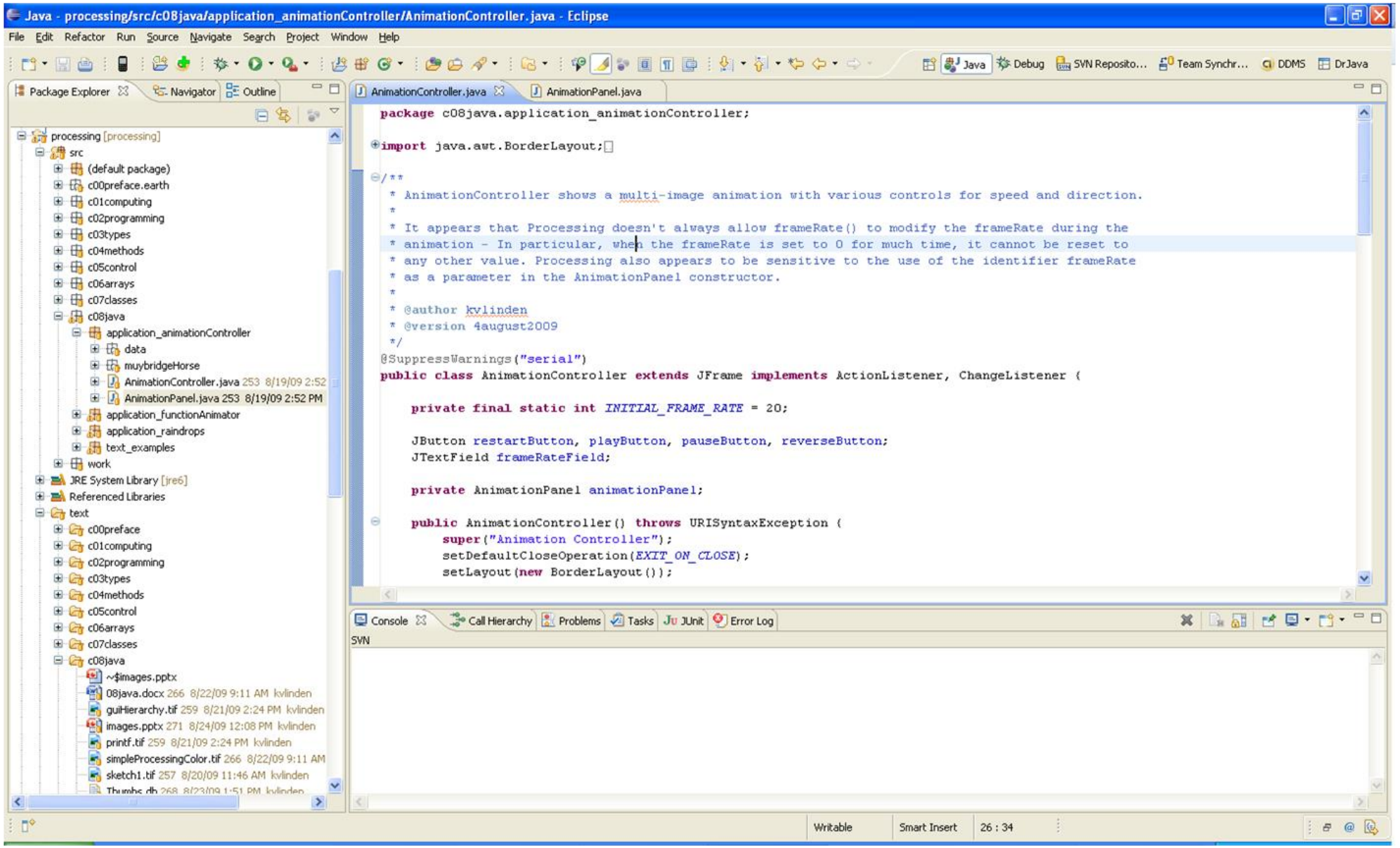
Eclipse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File Edit Refactor Run Source Navigate Search Project Window Help
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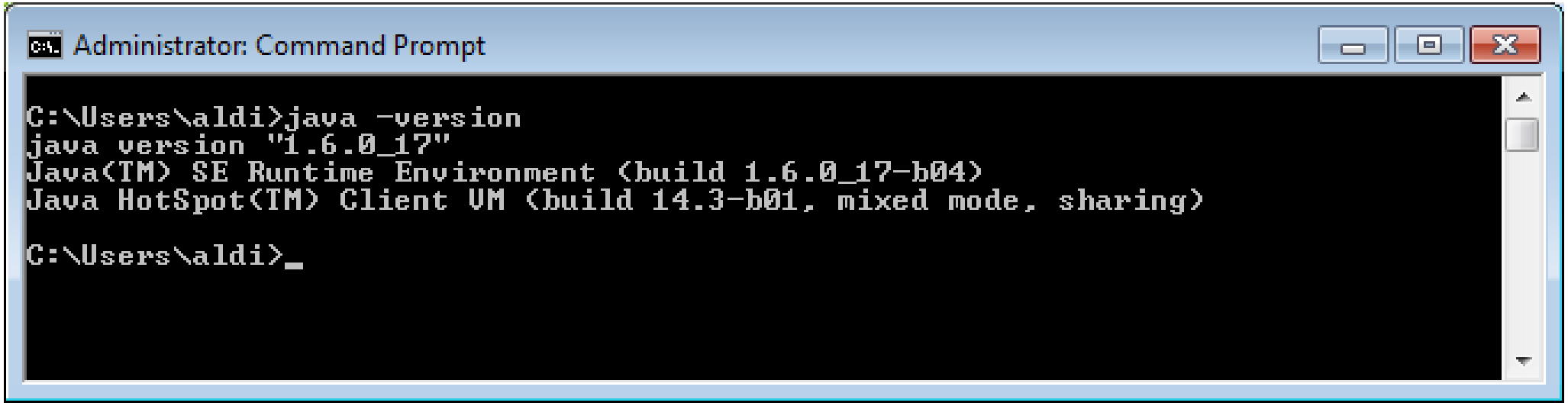
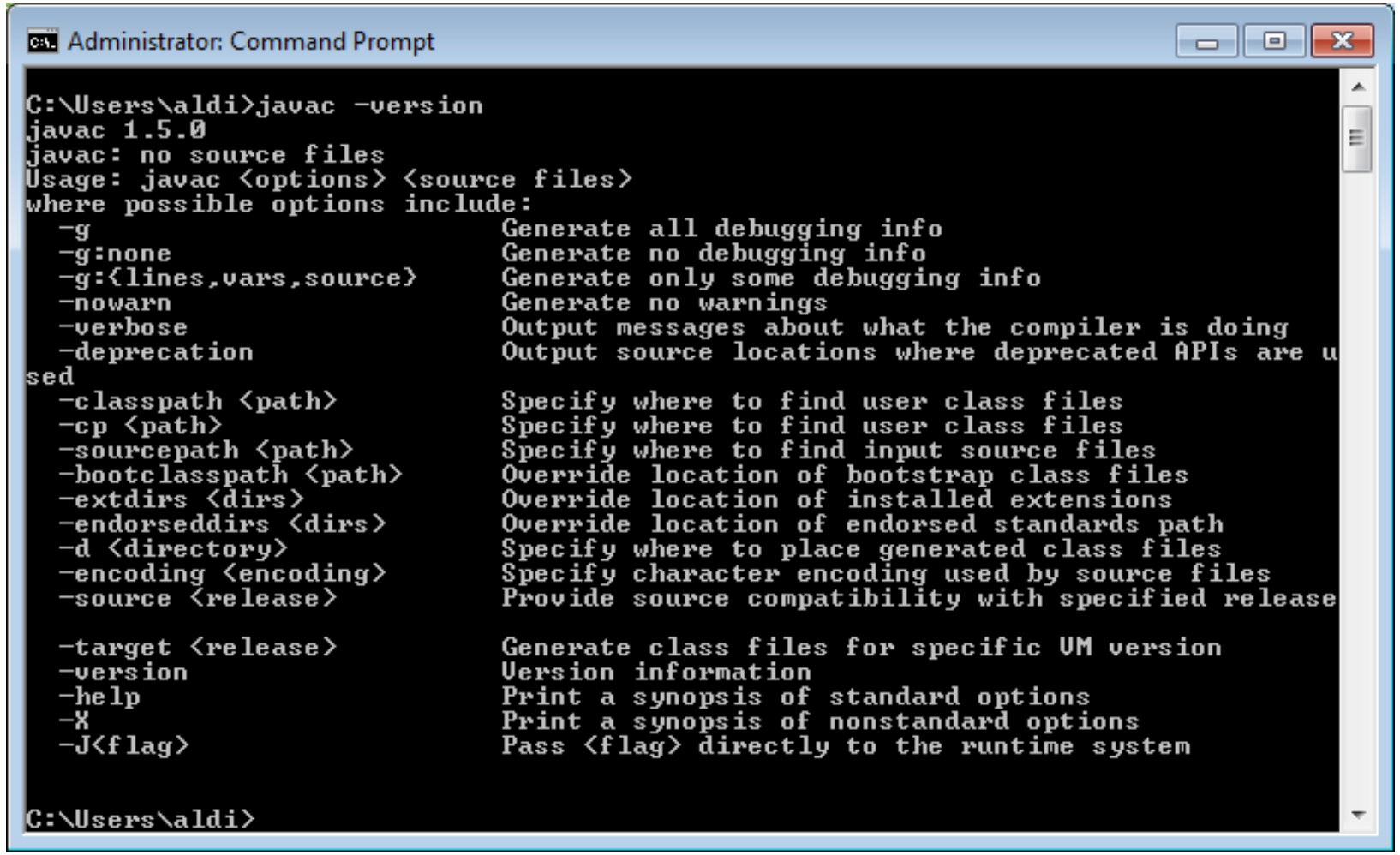
guiHierarchy.tif 259 8/21/09 2:24 PM kvlinden
images.pptx 271 8/24/09 12:08 PM kvlinden
printf.tif 259 8/21/09 2:24 PM kvlinden
simpleProcessingColor.tif 266 8/22/09 9:11 AM
sketch1.tif 257 8/20/09 11:46 AM kvlinden
package c08java.application_animationController;
import java.awt.BorderLayout;
/**
* AnimationController shows a multi-image animation with various controls for speed and direction.
*
* It appears that Processing doesn't always allow frameRate() to modify the frameRate during the
* animation - In particular, when the frameRate is set to 0 for much time, it cannot be reset to
* any other value. Processing also appears to be sensitive to the use of the identifier frameRate
* as a parameter in the AnimationPanel constructor.
*
* @author kvlinden
* @version 4august2009
*/
@SuppressWarnings("serial")
public class AnimationController extends JFrame implements ActionListener, ChangeListener {
private final static int INITIAL_FRAME_RATE = 20;
JButton restartButton, playButton, pauseButton, reverseButton;
JTextField frameRateField;
private AnimationPanel animationPanel;
public AnimationController() throws URISyntaxException {
super("Animation Controller");
setDefaultCloseOperation(EXIT_ON_CLOSE);
setLayout(new BorderLayout());
Console Call Hierarchy Problems Tasks JUnit Error Log
SVN
Writable Smart Insert 26 : 34

- Instalasilah JDK ke komputer anda dan ikuti semua instruksi untuk menginstalasinya.
- Aturlah nilai *environment variable* PATH melalui `Control Panel > System > Advanced > Environement Variables`

- Untuk mengetahui versi JRE (*java runtime environment*) yang terinstal:

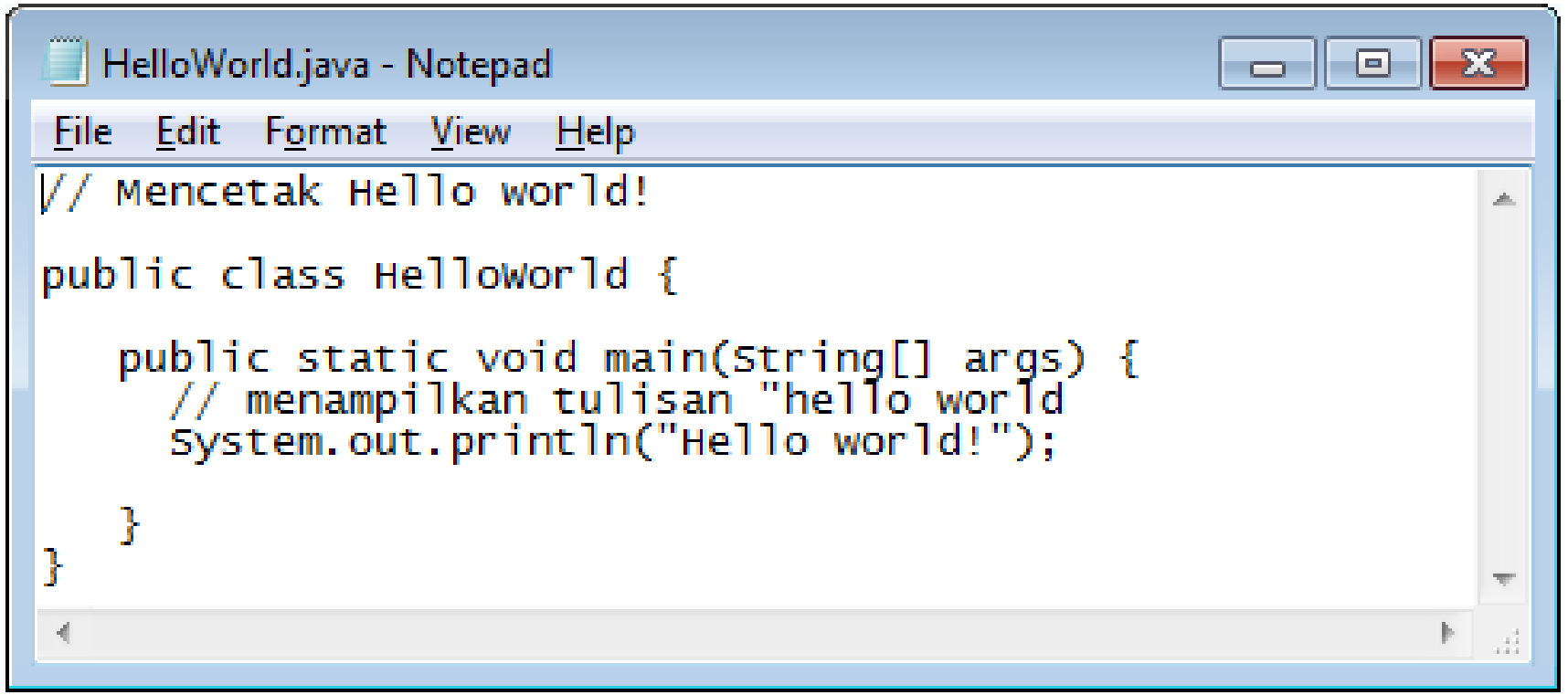


- Untuk mengetahui versi JDK yang terinstal:

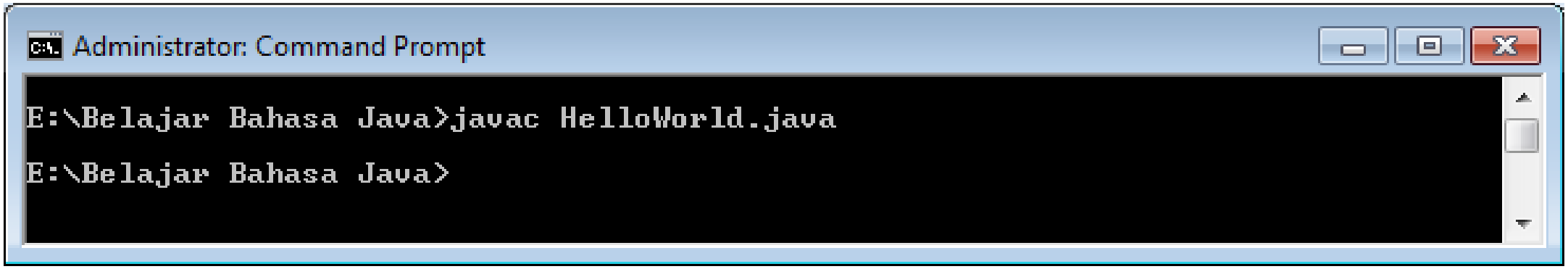


Program java-ku yang pertama

- Ketik program *HelloWorld* di bawah ini dengan editor teks, simpan dengan nama file `HelloWorld.java` (harus sama persis dengan nama class)



- Kompilasi program *HelloWorld* dari *command prompt*:



- Hasilnya sebuah arsip bernama `HelloWord.class`

- Jalankan arsip `HelloWorld.class` melalui *command prompt*:

- Horeeee..., saya sudah bisa membuat program java!

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Yang gue rasakan saat berhasil menulis program "Hello World" tanpa ada bug atau error

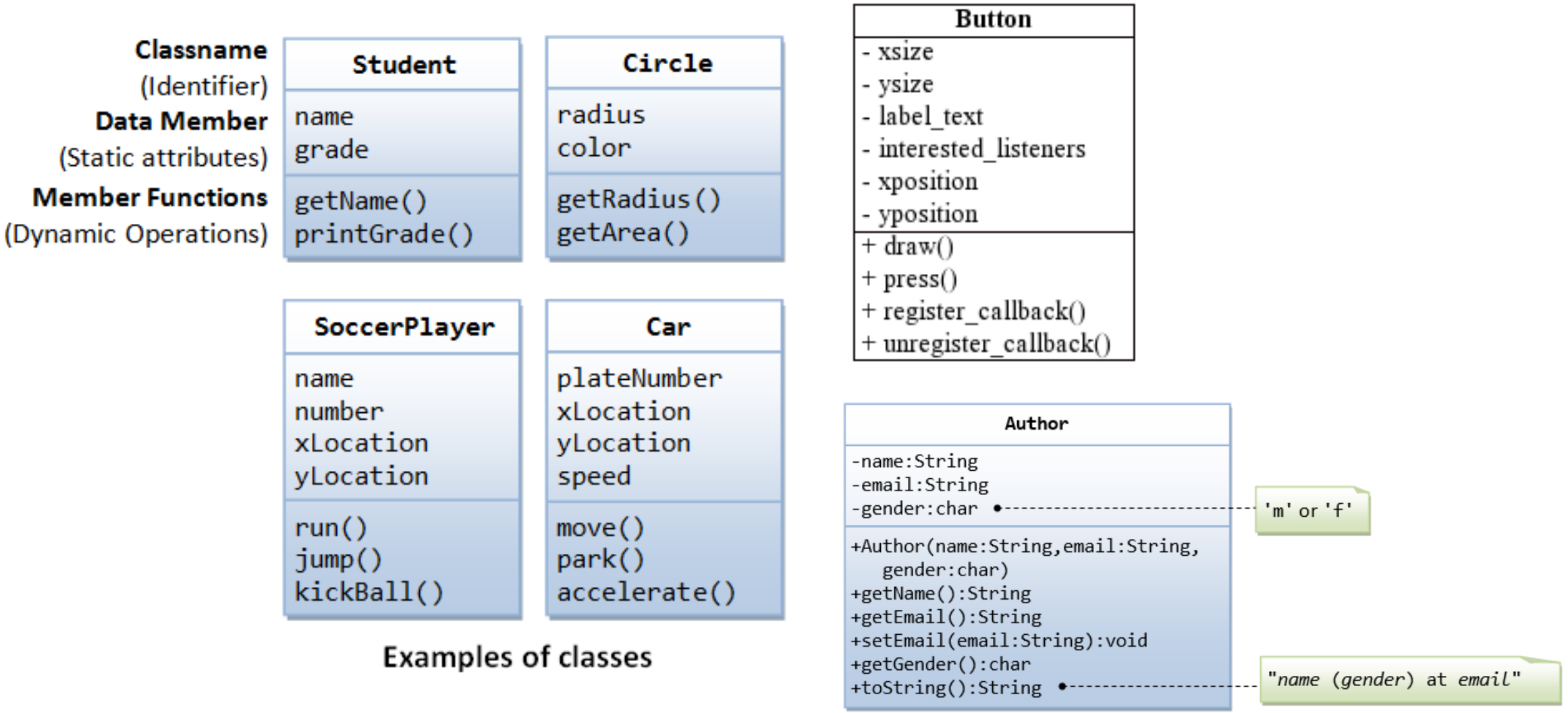
Class

- Bahasa java adalah berorientasi objek. Struktur bahasa java terdiri dari kelas-kelas objek.
- Kelas adalah *blue-print* dari objek, sedangkan objek adalah instans dari kelas pada saat ruuning.

- Setiap kelas di dalam java memiliki *template*:

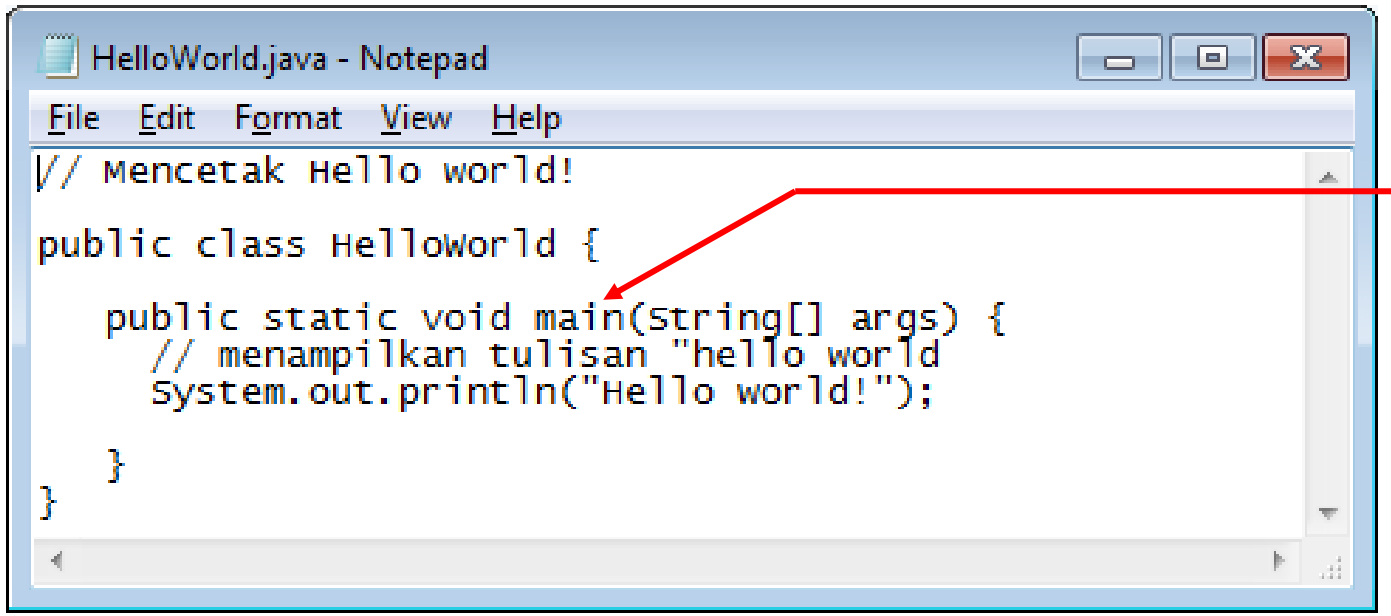
```
class NamaKelas {
  // body kelas ditulis di sini
}
```

- Di dalam kelas terdapat *atribut* (*data*) dan *method (function)*.
- Salah satu atau keduanya mungkin tidak terdapat di dalam kelas.



Examples of classes

- Atribut di dalam kelas dinyatakan dengan variabel atau objek kelas lain.
- *Method* adalah operasi (prosedur, fungsi, atau konstruktor) yang dimiliki oleh sebuah kelas.
- Kelas `HelloWorld` tidak mempunyai atribut tetapi hanya mempunyai satu *method,yaitu* `main`:



- Lebih lanjut mengenai kelas dan objek akan dipelajari di dalam kuliah *Pemrograman Berorientasi Objek* (di semester 4)

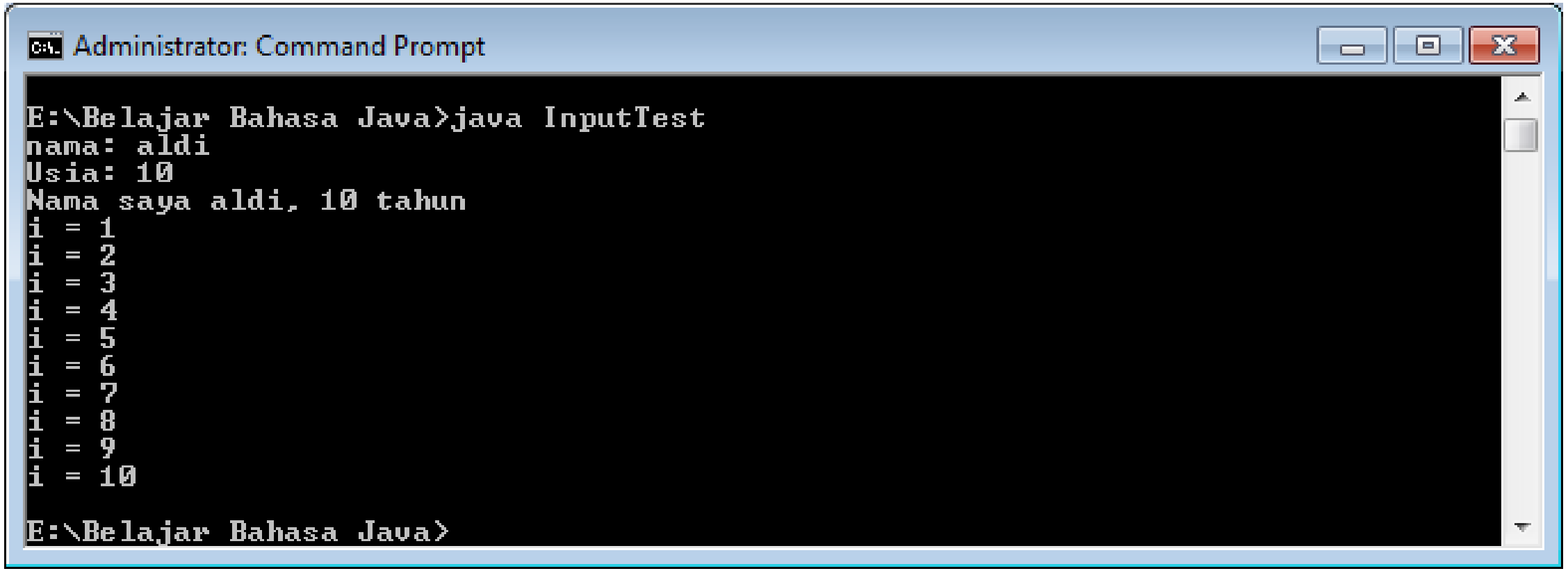
Program Input/Output Sederhana

InputTest.java - Notepad

File Edit Format View Help

```
/* Program input output sederhana */
import java.util.*;


public class InputTest {

   public static void main(String[] args) {
     Scanner in = new Scanner (System.in);
     System.out.print("nama: ");
     String nama = in.nextLine();

     System.out.print("Usia: ");
     int usia = in.nextInt();

     System.out.println("Nama saya " + nama + ", " + usia + " tahun");

     //Cetak angka dari 1 sampai usia
     int i;
     for (i=1;i<=usia; i++) {
         System.out.println("i = " + i);
     }
   }
}
```

- Kompilasi `InputTest.java` dan jika sudah benar jalankan programnya:



Program Input dengan GUI

InputTestGUI.java - Notepad

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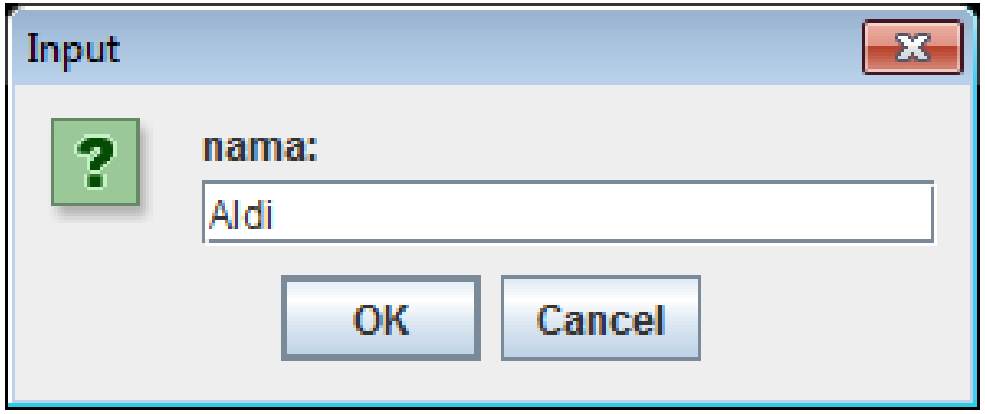
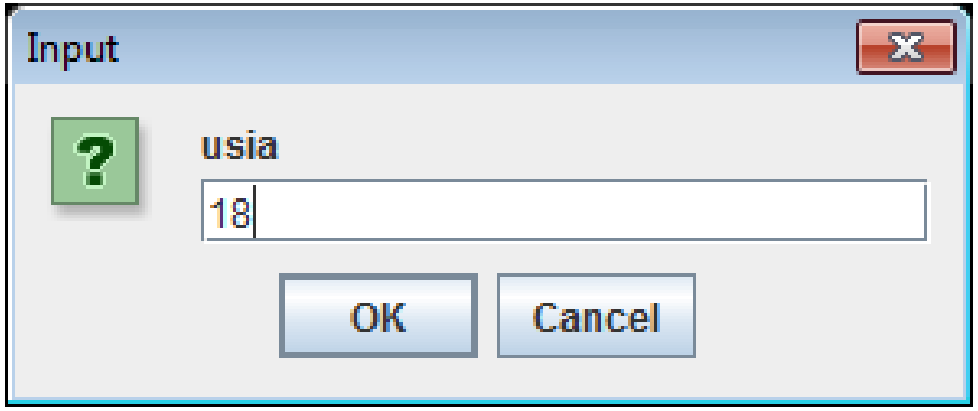
```
/* Program input output sederhana */
import javax.swing.*;


public class InputTestGUI {

   public static void main(String[] args) {
     String nama = JOptionPane.showInputDialog("nama: ");
     String usia = JOptionPane.showInputDialog("usia ");
     int usiaInt = Integer.parseInt(usia);

     System.out.println("Nama saya " + nama + ", usia " + usia + " tahun");
     System.exit(0);
   }
}
```

- Kompilasi `InputTestGUI.java` dan jika sudah benar jalankan programnya:





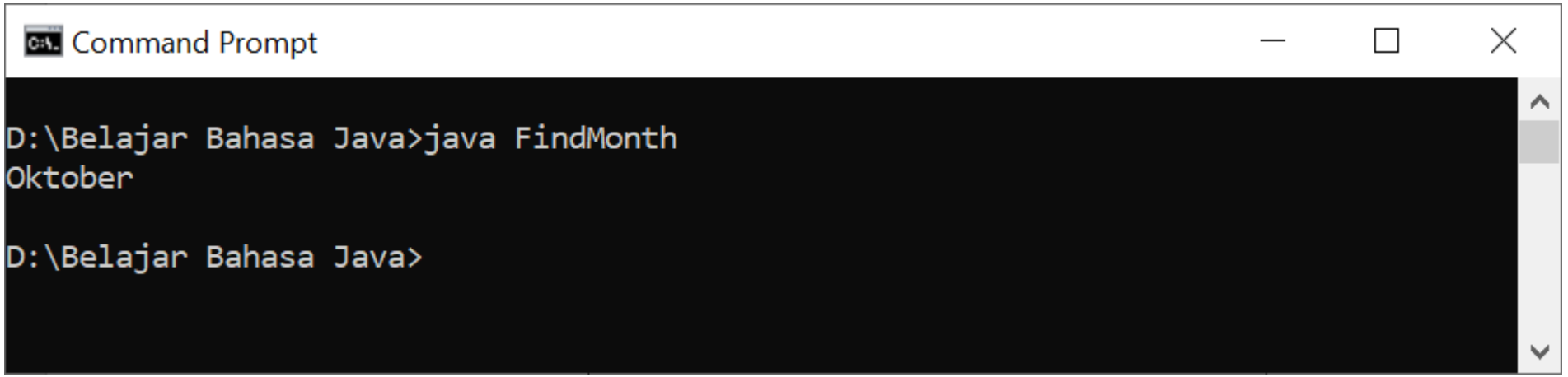
Program FindMonth

*FindMonth - Notepad

File Edit Format View Help

```
/* Program input output sederhana */
import javax.swing.*;

public class FindMonth {

   public static void main(String[] args) {

        String bulan = JOptionPane.showInputDialog("Bulan (1-12) ");
        int n = Integer.parseInt(bulan);
        switch (n) {
          case 1 : System.out.println("Januari"); break;
          case 2 : System.out.println("Februari"); break;
          case 3 : System.out.println("Maret"); break;
          case 4 : System.out.println("April"); break;
          case 5 : System.out.println("Mei"); break;
          case 6 : System.out.println("Juni"); break;
          case 7 : System.out.println("Juli"); break;
          case 8 : System.out.println("Agustus"); break;
          case 9 : System.out.println("September"); break;
          case 10 : System.out.println("Oktober"); break;
          case 11 : System.out.println("November"); break;
          case 12 : System.out.println("Desember"); break;
          default : System.out.println("Input tidak valid"); break;
        }

     System.exit(0);
   }
}
```

Ln 4, Col 1 | 100% | Windows (CRLF) | UTF-8


Command Prompt
D:\Belajar Bahasa Java>java FindMonth
Oktober
D:\Belajar Bahasa Java>

Input
Bulan (1-12)
10
OK
Cancel

Kelas Mahasiswa

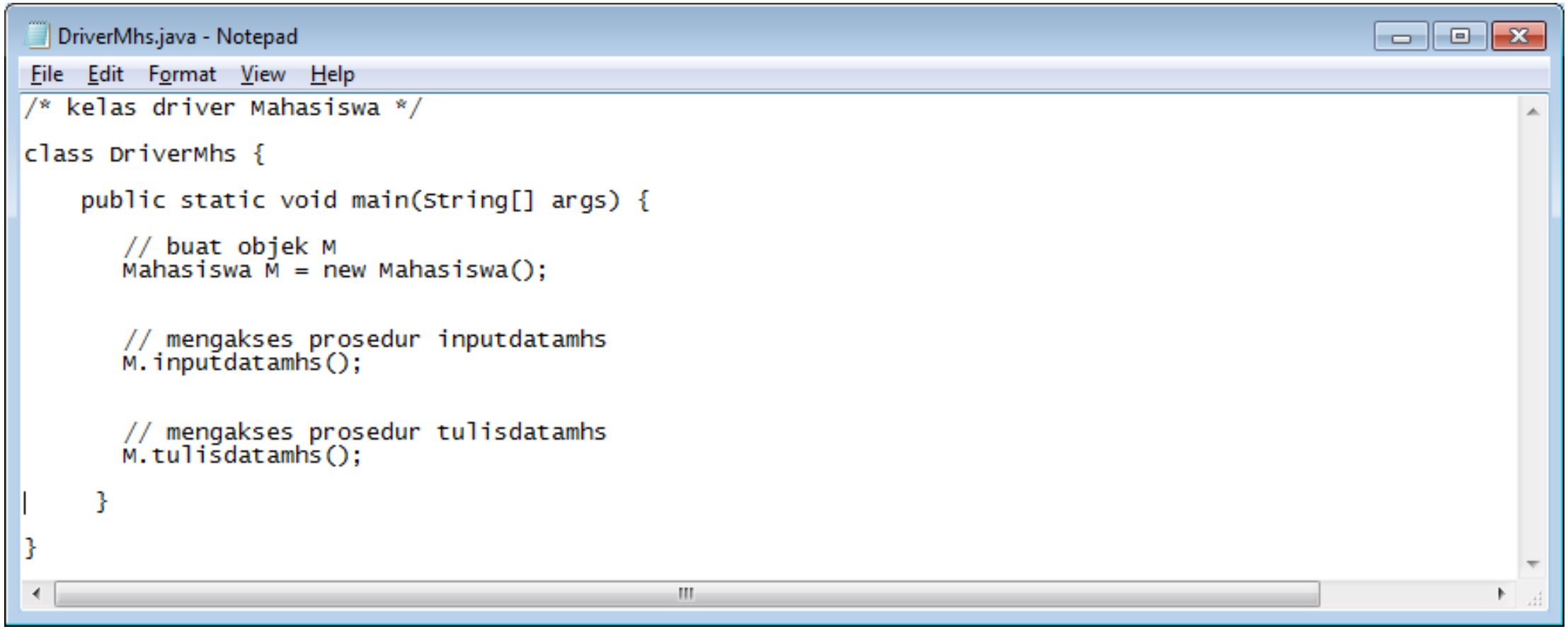
Mahasiswa.java - Notepad

File Edit Format View Help

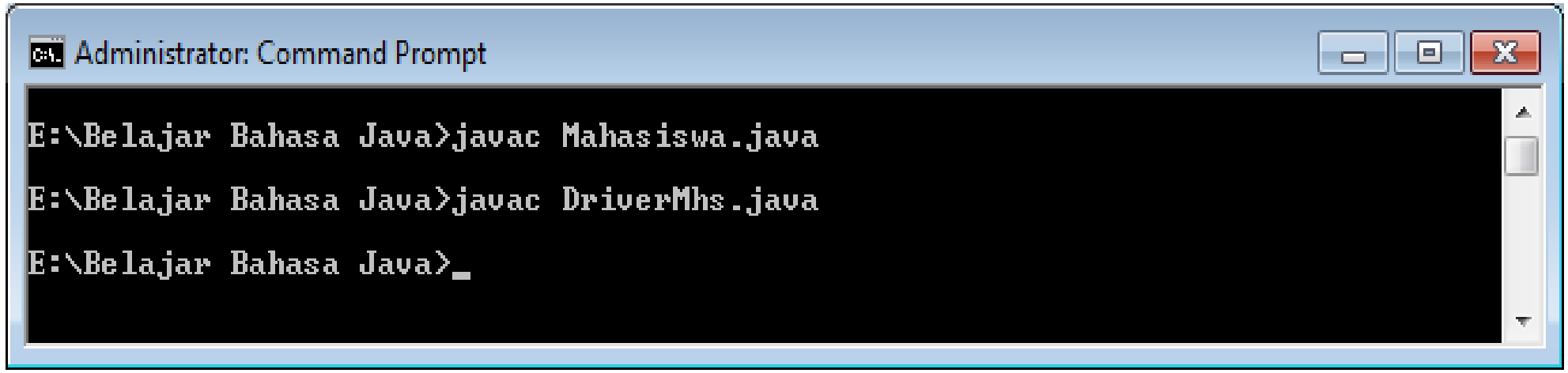
```
class Mahasiswa {

   //Atribut
   String nama;
   String nim;
   int usia;

   // Method:

   Mahasiswa() {   //Konstruktor:
   }

   void inputdatamhs() {
     Scanner in = new Scanner (System.in);
     System.out.println("Ketikkan data mahasiswa: ");
     System.out.print("Nama: ");
     String nama = in.nextLine();

     System.out.print("NIM: ");
     String nim = in.nextLine();

     System.out.print("Usia: ");
     int usia = in.nextInt();

     this.nama = nama;
     this.nim = nim;
     this.usia = usia;
   }

   void tulisdatamhs() {
      System.out.println();
      System.out.println("Data mahasiswa: ");
      System.out.println("Nama: " + this.nama);
      System.out.println("NIM: " + this.nim);
      System.out.println("Usia: " + this.usia);
   }
}
```

Kelas DriverMhs

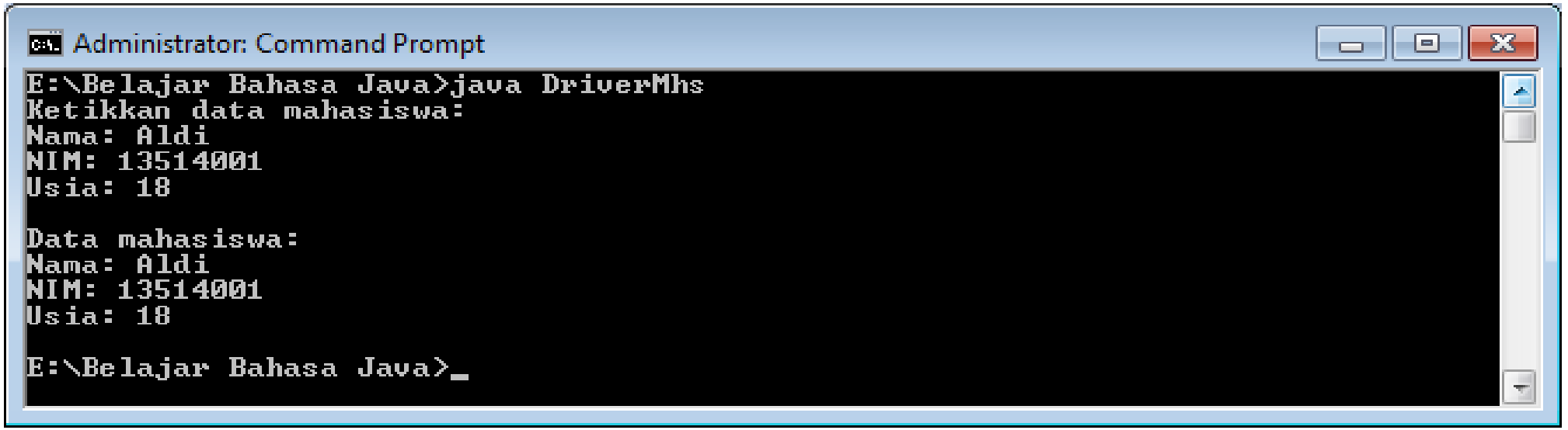
(yang menggunakan kelas Mahasiswa)



- Kompilasi masing-masing `Mahasiswa.java` dan `DriverMhs.java`



- Jalankan kelas `DriverMhs.class`



Kelas Matriks

matriks.java - Notepad

File Edit Format View Help

```
class matriks {

   //Atribut
   int[][] Mat = new int[10][10];

   // Method:

   matriks() {    //Konstruktor:
     int i, j;

     for (i=1;i<10; i++) {
       for (j=1; j<10; j++) {
         this.Mat[i][j] = 0;
       }
     }
   }

   void isimatriks(int N, int M) {
   // Mengisi elemen matriks M[i,j] dengan nilai i+j
     int i, j;

     for (i=0;i<N; i++) {
       for (j=0; j<M; j++) {
         this.Mat[i][j] = i+j;
       }
     }
   }
```

matriks.java - Notepad

File Edit Format View Help

```
   void tulismatriks(int N, int M) {
   // Mencetak elemen-elemen matriks
     int i, j;

     for (i=0;i<N; i++) {
       for (j=0; j<M; j++) {
         System.out.print(this.Mat[i][j] + " ");
       }
       System.out.println();
     }
   }

   void transpose(int N, int M, int Matt[][]) {
   // Membuat matriks transpose;
     int i, j;

     for (i=0;i<N; i++) {
       for (j=0; j<M; j++) {
         Matt[j][i] = this.Mat[i][j];
       }
     }
   }

}
```

Kelas DriverMatriks

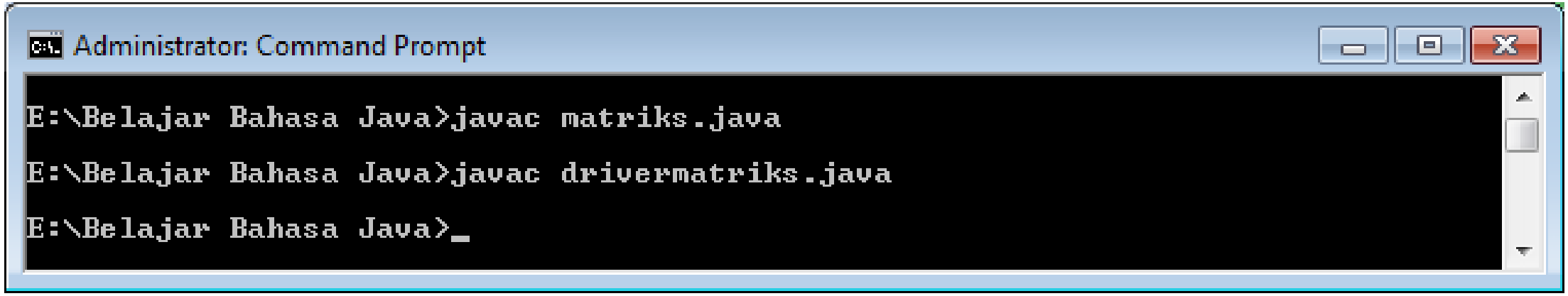
(yang menggunakan kelas Mahasiswa)

DriverMatriks.java - Notepad

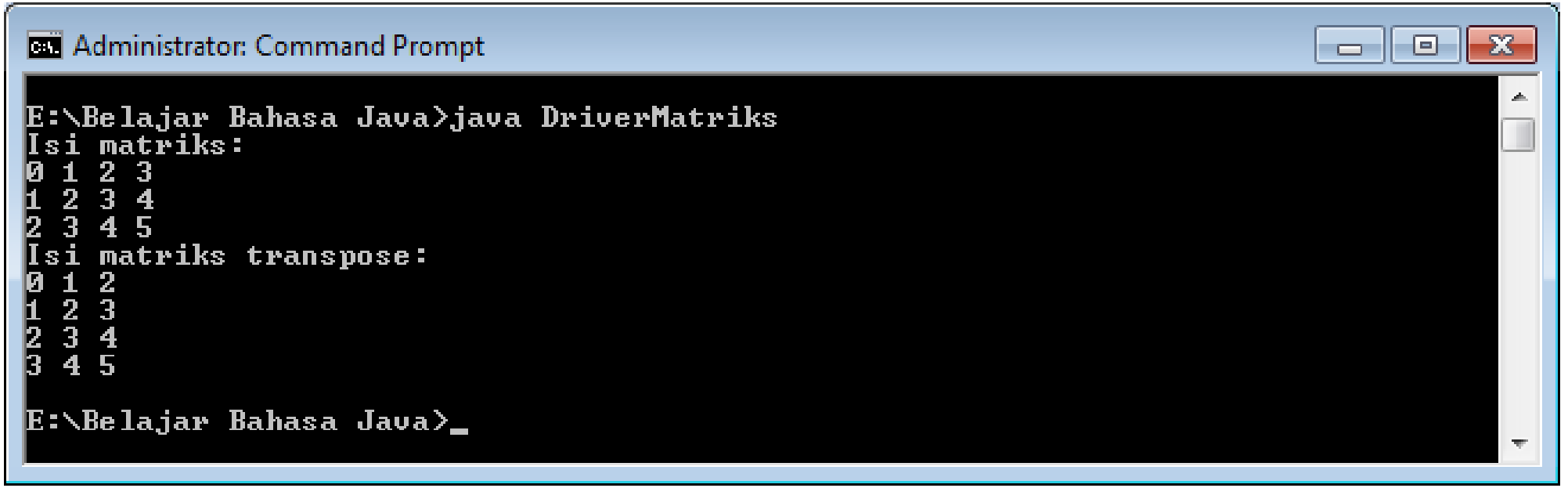
File Edit Format View Help

```
/* kelas driver Matriks */

class DriverMatriks {

    public static void main(String[] args) {
       // buat objek P1
       matriks M = new matriks();


       // mengisi matriks
       M.isimatriks(3,4);

       // menulis matriks
       System.out.println("Isi matriks: ");
       M.tulismatriks(3, 4);

       // membuat matriks transpose
       int[][] M2;
       M2  = new int[4][3];
       M.transpose(3,4,M2);

       // Tulis matriks  transpose
       System.out.println("Isi matriks transpose: ");
       int i, j;
       for (i=0;i<4; i++) {
         for (j=0; j<3; j++) {
            System.out.print(M2[i][j] + " ");
       }
       System.out.println();
     }
   }

}
```

- Kompilasi masing-masing `matriks.java` dan `DriverMatriks.java`



- Jalankan kelas `DriverMatriks.class`



Kelas Stack

Stack - Notepad

File Edit Format View Help

```
/* kelas Stack */

class Stack {

   //Atribut
   public int TOP;
   public int[] s = new int[11];

   //Konstruktor:
   Stack() {
      this.TOP = 0;

      System.out.println("Telah dibuat sebuah stack");
      this.tulis();

   }


   // Metode lain:

   void tulis() {
      System.out.println("TOP = " + this.TOP);
   }
```

Ln 1, Col 1 | 100% | Windows (CRLF) | UTF-8

Stack - Notepad

File Edit Format View Help

```
   void tulis() {
      System.out.println("TOP = " + this.TOP);
   }

   void push(int x){
      this.TOP ++;
      //if (this.TOP > N-1)
      //   System.out.println("stack penuh");
      // else
      s[TOP] = x;

   }

   int pop(){
       if (this.TOP == 0) {
           System.out.println("stack kosong");
           return 0;
       }
       else {
          int x = s[TOP];
          this.TOP--;
          return x;
       }

   }

}
```

Ln 1, Col 1 | 100% | Windows (CRLF) | UTF-8

Kelas mainStack

(yang menggunakan kelas Stack)

mainStack - Notepad

File Edit Format View Help

```
class mainStack {

    public static void main(String[] args) {
       int N = 11;
       // buat objek stack

       Stack S = new Stack();

       boolean penuh = false;

       Scanner in = new Scanner(System.in);

       while (!penuh)
        {
          System.out.print("Elemen stack?");
          int i = in.nextInt();
          if (S.TOP >= N-1) {
             System.out.println("Stack penuh");
             penuh = true;
          }
          else
            S.push(i);
       }
```

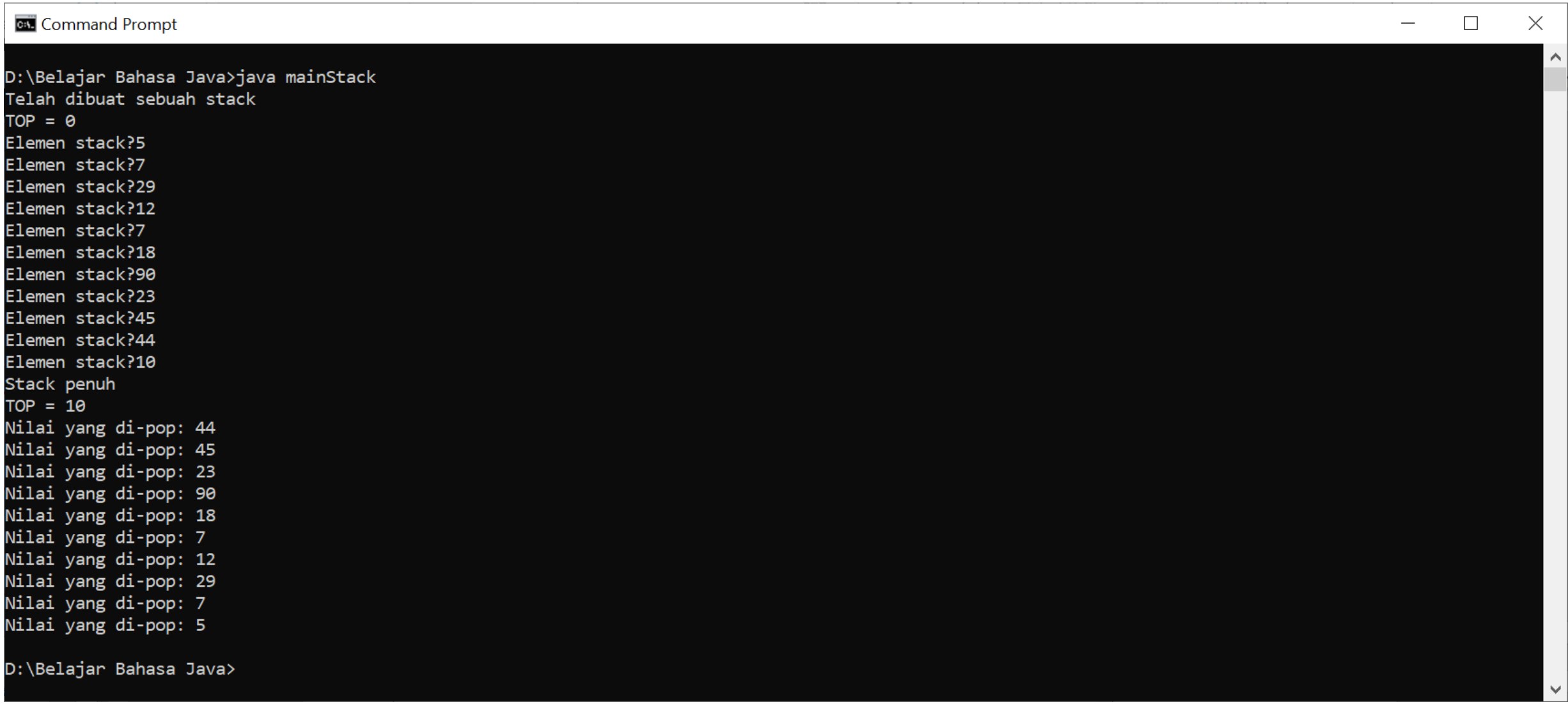
Ln 1, Col 1 | 100% | Windows (CRLF) | UTF-8

mainStack - Notepad

File Edit Format View Help

```
        S.tulis();

        // mengakses elemens stack
        int j = S.TOP;
        while (j != 0)
         {
           int x = S.pop();
           System.out.println("Nilai yang di-pop: " + x);
           j = S.TOP;
         }

    }

}
```

Ln 1, Col 1 | 100% | Windows (CRLF) | UTF-8


Command Prompt
D:\Belajar Bahasa Java>java mainStack
Telah dibuat sebuah stack
TOP = 0
Elemen stack?5
Elemen stack?7
Elemen stack?29
Elemen stack?12
Elemen stack?7
Elemen stack?18
Elemen stack?90
Elemen stack?23
Elemen stack?45
Elemen stack?44
Elemen stack?10
Stack penuh
TOP = 10
Nilai yang di-pop: 44
Nilai yang di-pop: 45
Nilai yang di-pop: 23
Nilai yang di-pop: 90
Nilai yang di-pop: 18
Nilai yang di-pop: 7
Nilai yang di-pop: 12
Nilai yang di-pop: 29
Nilai yang di-pop: 7
Nilai yang di-pop: 5
D:\Belajar Bahasa Java>

Referensi

Materi “Pengantar Pemrograman Bahasa Java” diambil dari berbagai sumber, antara lain:

1. Arief Bahtiar S.T, M.T, Ivan Kurniawan, *Fundamental Java 2 Platform Application Developer*, ComLabs IT Course ITB.
2. Adi Nuralim, *Java Virtual Machine*, http://belajarjava-19.blogspot.co.id/2011/05/java-virtual-machine-jvm.html, tanggal akses 3 September 2015
3. Wikipedia