AP CS Java Syntax Summary: (version 5)

CLASSES & METHODS

Class & main:

```
public class name {
    public static void main(String[] args) {
        statement;
        ...
        statement;
    }
}
```

Method creation:

```
      public static <type OR void> name(type <parameter name>,…, type <parameter name>) {
            statement;
            ...
            statement;
            return expression;
      }

      name();  // Calling a Static Method with no parameters
      name (value, value, ..., value);  // Calling a Method with Parameter(s)
      variable = name (value1, value2, ..., valueN);  // calls the Method "name" with
            // the parameters values: value1 – valueN and returns a value to variable
      type variable = name (value1, value2, ..., valueN);  // calls the Method "name"
            // with the parameter values: value1 – valueN and assigns the returned value
            // to "variable", which is created as the appropriate type
```

Example Method with no parameters or return value:

```
      public static void printHeader() {
            System.out.println("Welcome to the wonderful Program.");
            System.out.println("Hope you enjoy our hard work");
      }
```

Example Method call with no parameters or returned value (statements from another method):

```
      printHeader(); // call of printHeader, simply prints out the two lines
```

Example Method with parameters and return value:

```
      public static int addThree(int oneValue, int twoValue, int threeValue) {
            int sum = oneValue + twoValue;
            sum = sum + threeValue;
            return sum;
      }
```

Example Method call with parameters and returned value (statements from another method):

```
      mySum = addThree(100, 20, 3); // assigns integer 123 to the existing integer
                                    // variable, mySum
      int addedValues = addThree(100, 20, 3); // assigns integer 123 to newly created
                                              // integer variable, addedValues
```

Comments:

```
// comment text, on one line
/* comment text; may span multiple lines */
```

Println – Println:

```
System.out.println("<string>");  // Prints string then a new line
System.out.print ("<string>");   // Prints just the string
```

Escape Character within a string: the backslash ****

Note: the AP test sheet will not be this detailed. Garfield HS, Mr. Bergquist for AP CS, 2011-2012

VARIABLES:

Primitive Variable Types:

```
int name = <value>; // creates an Integer and assigns value to it
double name = <value>; // creates an Double – real numbers, and assigns value to it
char name = '<single character>'; // creates a single character like 'a', '1', ' ', etc.
boolean name = true;  // creates a Boolean of true or false, and assigns true to it
```

Other Variable Types:

```
String name = "<series of characters>"; // creates a String and assigns the string to it
```

Class Constant:

```
public static final type NAME = value; // Class constant names in all upper case letters
                  // usually placed just under the Class definition above main method
```

Updating Variables:

Assigning a value:

```
variable = <value or expression>; // variable's value is replaced with the new value
                                  // or the value of an expression
```

Example Assignments:

```
x = 12; // assigns the value 12 to x
y = x + 5 * 32;  // the value for the expression (x + 5 * 32) is assigned to y
z = z + 1;  // z is incremented by 1
date = getDate(console); // Returned value the method getDate called with the console
                         // parameter is assigned to date
```

Shorthand	Equivalent longer version
`variable++;`	`variable = variable + 1;`
`variable--;`	`variable = variable - 1;`
`variable += value;`	`variable = variable + value;`
`variable -= value;`	`variable = variable - value;`
`variable *= value;`	`variable = variable * value;`
`variable /= value;`	`variable = variable / value;`
`variable %= value;`	`variable = variable % value;`

Logical Operators: (used in tests to determine a Boolean true of false value)

Operator	Meaning	Example	Value
==	equals	1 + 1 == 2	true
!=	does not equal	3.2 != 2.5	true
<	less than	10 < 5	false
>	greater than	10 > 5	true
<=	less than or equal to	126 <= 100	false
>=	greater than or equal to	5.0 >= 5.0	true
&&	AND	(2 == 3) && (-1 < 5)	false
||	OR	(2 == 3) || (-1 < 5)	true
!	NOT	!(2 == 3)	true

FLOW CONTROL

for Loop:

```
for (initialization; test; update) {
    statement(s);
}
```

Example:

```
for (int i = 1; i <= 6; i++) {
    System.out.println("I am so smart");
}
```

Cumulative Sum Example: (code snippet from inside a method)

```
int sum = 0;
for (int i = 1; i <= 1000; i++) {
      sum = sum + i;
}
System.out.println("The sum is " + sum);
```

if Statement:

```
if (test) {
    statement(s);
}
```

if Example:

```
if (GPA >= 3.5) {
    System.out.println("You are so smart");
}
```

if / else Statement:

```
if (test) {
    statement(s);
} else {
    statement(s);
}
```

if / else Example: (exactly one path will be executed)

```
if (GPA >= 3.5) {
    System.out.println("You are so smart");
} else {
    System.out.println("Study more please");
}
```

if / else / if Statement: (one or no path may be executed)

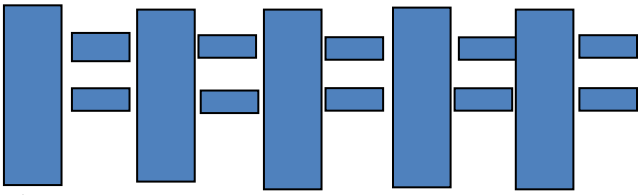
```
if (test) {
    statement(s);
} else if {
    statement(s);
}
```

Nested if / else / if Example:

```
if (place = 1) {
    System.out.println("Gold Medal!");
} else if (place = 2) {
    System.out.println("Silver Medal!");
} else if (place = 3) {
    System.out.println("Bronze Medal!");
}
```

Fencepost Loop:
Adds a statement outside the loop to place the initial "post." Also called a fencepost loop or a "loop-and-a-half" solution.

```
      place a post.
      for (length of fence - 1) {
          place some wire.
          place a post.
      }
```

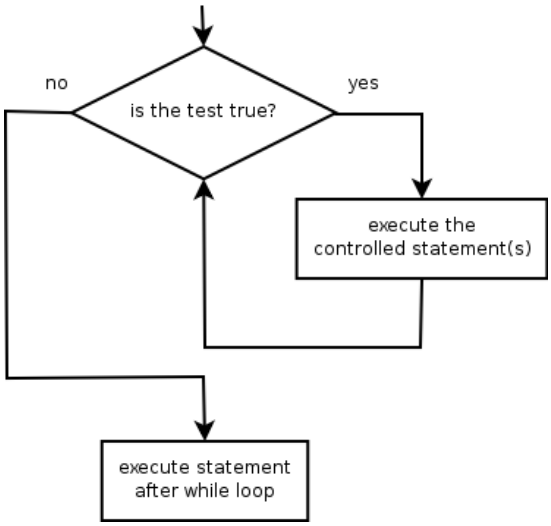


```
public static void printNumbers(int max) {
    System.out.print(1);
    for (int i = 2; i <= max; i++) {
        System.out.print(", " + i);
    }
    System.out.println(); // to end the line
}
```

definite loop: Executes a known number of times. (i.e. most counting for loops)
indefinite loop: One where the number of times its body repeats is not known in advance.

while Loop:

```
      while (test) {
         statement(s);
      }
```



while loop Example: prints powers of 2 less than 200

```
      int num = 1;             // initialization
      while (num <= 200) {     // test
          System.out.print(num + " ");
          num = num * 2;       // update
      }
```

Sentinel value: A value that signals the end of user input.
Sentinel loop: Repeats until a sentinel value is seen.

KEY OBJECTS & THEIR METHODS

Objects:

Constructing (creating) an object:

```
Type objectName = new Type(parameters);
```

Calling an object's method:

```
objectName.methodName(parameters);
```

Drawing Panel & Graphics Objects:

Required Library for these:

```
import java.awt.*;  // this import is requried for Graphics above the Class
```

Object Creations:

```
DrawingPanel panelName = new DrawingPanel(width, height);  // creates Drawing Panel
Graphics graphicName = panelName.getGraphics();  // creates the graphics object
Color colorName = new Color(red, green, blue);  // creates a color with RGB values
Polygon polygonName = new Polygon();  // creates a polygon
```

Key Drawing Panel Methods:

```
panelName. setBackground(colorName);  // sets the background color of the panel
panelName.clear(); // Erases any shapes that are drawn on the drawing panel.
panelName.setWidth(width); // Changes the drawing panel's width
panelName.setHeight(height); // Changes the drawing panel's height
panelName.setSize(width, height); // Changes the drawing panel's width & heigth
panelName.save(filename);  //Saves the image on the panel to the given filename
panelName.sleep(ms); //Pauses the drawing for the given number of milliseconds
```

Key Graphics Methods:

```
graphicName.drawLine(x1, y1, x2, y2);  // draws a line from points 1 to 2
graphicName.drawOval(x, y, width, height);  // draws an Oval's outline
graphicName.drawRect(x, y, width, height);  // draws an Rectangle's outline
graphicName.drawString(text, x, y);  // draws out the text string
graphicName.fillOval(x, y, width, height);  // draws a filled Oval
graphicName.fillRect(x, y, width, height);  // draws a filled Rectangle
graphicName.setColor(Color);  // Sets the color for drawing
graphicName.fillPolygon(polygonName); // fills the Polygon with the current color
```

Key Color Methods/values:

```
Color.CONSTANT_NAME  // values for preset colors, where CONSTANT_NAME is:
      BLACK, BLUE, CYAN, DARK_GRAY, GRAY, GREEN, LIGHT_GRAY, MAGENTA, ORANGE,
      PINK, RED, WHITE, YELLOW
```

Key Polygon Method:

```
polygonName.addPoint(x, y);  // adds a point to the Polygon at x,y coordintate
```

Key Math Methods: (of the Math Class)

```
Math.abs(value) // absolute value
Math.ceil(value) // rounds up
Math.floor(value) // rounds down
Math.log10(value) // logarithm, base 10
Math.max(value1, value2) // larger of two values
Math.min(value1, value2) // smaller of two values
Math.pow(base, exp) // base to the exp power
Math.random() // random double between 0 and 1
Math.round(value) // nearest whole number
Math.sqrt(value) // square root
Math.sin(value) // sine of an angle in radians
Math.cos(value) // cosine of an angle in radians
Math.tan(value) // tangent of an angle in radians
Math.toDegrees(value) // convert radians to degrees
Math.toRadians(value) // convert degrees to radians
```

Scanner & File Objects:

Required Library for these: (placed above the Class creation

```
import java.util.*;     // required for Scanner Object
import java.io.*;       // required for File Object
```

Scanner & File Object Creations:

```
Scanner name = new Scanner(source);
File name = new File("file name");
```

Examples:

```
Scanner console = new Scanner(System.in); // creates Scanner named "console" that
                                          // reads from the input (keyboard)
File fileHere = new File("mydata.txt");   // creates File named "fileHere" that
                                          // accesses the file mydata.txt
Scanner input = new Scanner(fileHere);    // creates Scanner named "input" that
            // reads from the file "fileHere", which is accessing "mydata.txt"
```

Scanner Methods: (`s` is the Scanner object)

```
s.nextInt()  reads an int from the user and returns it
s.nextDouble()  reads a double from the user
s.next()  reads a one-word String from the user
s.nextLine()  reads a one-line String from the user
```

Scanner Test Methods

```
s.hasNext() // returns true if there is a next token
s.hasNextInt() // returns true if there is a next token & it can be read as an int
s.hasNextDouble() // returns true if there is a next token and it can
                  // be read as a double
s.hasNextLine()   // returns true if there are any more lines of input to read
                  //  (always true for console input)
```

File Methods: (`f` is the File object)

```
f.delete() removes file from disk
f.getName() returns file's name
f.length() returns number of bytes in file
f.renameTo(file) changes name of file
```

File Test Methods

```
f.canRead() returns whether file is able to be read
f.exists() whether this file exists on disk
```

Key String Methods: (operates on String type, s is the object here…)

```
s.indexOf(str) // index where the start of the given string appears
                        //in this string (-1 if not found)
s.length()        // number of characters in this string
s.substring(index1, index2) // the characters in this string from index1
                                    // (inclusive) to index2 (exclusive);
s.substring(index1) // if index2 is omitted, grabs till end of string
s.toLowerCase()  // a new string with all lowercase letters
s.toUpperCase()  // a new string with all uppercase letters
s.charAt(int)  // accepts an int index parameter and returns the char at
                        // that index
```

String Test Methods:

```
s.equals(str)  // whether two strings contain the same characters
s.equalsIgnoreCase(str) // whether two strings contain the same
                                  // characters, ignoring upper vs. lower case
s.startsWith(str)  // whether one contains other's characters at start
s.endsWith(str)  // whether one contains other's characters at end
s.contains(str)  // whether the given string is found within this on
```

Arrays (BJP Chapter 7):

Required Library for these: (placed above the Class creation

```
import java.util.*;     // required for Arrays
```

Array Creation and use:

```
type[] name = new type[length];
type[] name = {value0, value1, ..., valueN};  // initializing an array explicitly
name [index] = value;  // Assigning a value to an array's indexed location
public static type methodName(type[] name) {  // using an array as a parameter
public static type[] methodName(parameters) { // returning an array
methodName(arrayName);  // calling a method with an array as its parameter
type[] name = methodName(parameters);  // assigning an array as a returned result
```

Examples:

```
double[] numbers = double int[8]; // creates an array of doubles with 8 elements
int[] values = {11, 42, -5, 27, 0, 89};   // creates an array of integers with the
                                          // specified values of length 6
public static void actOnIt(double[] input) {} // a double array as a parameter
public static boolean[] figureItOut(int x, int y) {} // returning a boolean array
actOnIt(numbers);  // calling a method with an array as its parameter
boolean[] values = figureItOut(x, y);  // assigning an array as a returned result
```

Array Length Field:

```
name.length  // returns the integer length of the array, note no parenthesis
```

Examples:

```
int arrayLength = numbers.length;  // Assigns the length of the array to a variable
for (int i = 0; i < numbers.length; i++) {      // for loop going through an array
}                                               // one by one element at at a time
```

Array Methods: (for the Arrays class)

```
Arrays.equals(array1, array2) // returns true if the two arrays contain same
                              // elements in the same order
Arrays.toString(array)  // returns a string representing the array, such as
                        // "[10, 30, -25, 17]"
Arrays.copyOf(array, length)  // returns a new copy of an array
Arrays.fill(array, value)     // sets every element to the given value
Arrays.sort(array)                  // arranges the elements into sorted order
Arrays.binarySearch(array, value)   // returns the index of the given value in a
                                    // sorted  array (or < 0 if not found)
```

2D Arrays (BJP Chapter 7.5):

2D Array Creation and use:

```
type[][] name = new type[height][width];
type[][] name = { {value00, value01, ..., value0w},
                  {value10, value11, ..., value1w},
                   ...
                  {valueh0, valueh1, ..., valuehw} }
                       // initializing an array explicitly
name [indexh][indexw] = value;  // Assigning a value to an array's indexed location
public static type methodName(type[][] name) {  // using an array as a parameter
public static type[][] methodName(parameters) { // returning an array
methodName(arrayName);  // calling a method with an array as its parameter
type[][] name = methodName(parameters);  // assigning an array as a returned result
```

2D Array Examples:

```
char[][] board = new char[3][3];  // creates an array of chars 3 by 3, 9 elements
char[][] board = {{'X', 'O', 'X'},
                  {'O', 'X', 'O'},
                  {'X', 'O', 'X'}};
public static void PlayGame(cher[][] input) {} // a char 2D array as a parameter
public static boolean[][] emptyLoc(int x, int y) {} // returning a 2D boolean array
printBoard(board);  // calling a method with a 2D array as its parameter
boolean[] values = emptyLoc(x, y);  // assigning a 2D array as a returned result
```

Jagged 2D Array Examples:

```
int[][] jagged = new int[3][];
jagged [0] = new int[2];
jagged [1] = new int[5];
jagged [2] = new int[4];
```

2D Array Length Field:

`nums.length` – returns array's height or number of rows (no [ ])

`nums[0].length` – returns array's width or columns - at that row [ ], which is the same for regular arrays.

Examples: for a 2D Array:

```
int[][] nums = new int[5][4];
```

Length results would be:

```
nums.length is 5
nums[0].length is 4
```

All rows same width here. Note: these would differ for a Jagged Array

```
nums[1].length is 4
nums[2].length is 4…
```

Acting on 2D arrays usually involves nested for loops using the length dimensions – keep track of row & columns carefully and name variables wisely.

```
public static void fillArray (int nums[][]){
   int count = 1;
   for (int row = 0; row < nums.length ; row++){
      for (int col = 0; col < nums[0].length ; col++){
         <statements...>
      }
   }
}
```

ArrayList: (BJP Chapter 10)
Required Library for these: (placed above the Class creation)

```
import java.util.*;     // required for Arrays
```

Array Creation and use:

```
ArrayList<Type> name = new ArrayList<Type>();
name.add("Your Name");  // Assigning a value to the end of an ArrayList name
public static type methodName(ArrayList<Type> name){  // ArrayList as a parameter
public static ArrayList<Type> methodName(parameters) { // returning an ArrayList
methodName(arrayListName);  // calling a method with an ArrayList as its parameter
ArrayList<String> names = methodName(parameters);  // ArrayList as returned result
```

Examples:

```
ArrayList<String> names = new ArrayList<String>(); // creates ArrayList of Strings
public static void actOnIt(ArrayList<String> input) {} // ArrayList as a parameter
      // returning a boolean ArrayList, using "Integer" as the wrapper for int
public static ArrayList<Integer> figureItOut(int x, int y) {}
actOnIt(names);  // calling a method with an array as its parameter
ArrayList<Integer> values = figureItOut(x, y); // an ArrayList as a returned result
```

ArrayList Size Method:

```
name.size() // returns the integer size of an ArrayList, includes parenthesis
```

Examples:

```
ArrayList<Integer> list = new ArrayList<Integer>(); // Creates ArrayList of int's
for (int i = 1; i <= 10; i++) {
    list.add(10 * i);   // [10, 20, 30, 40, ..., 100]
}
for (int i = 0; i < list.size(); i++) {   // for loop going through an ArrayList
    ...  // NOTE: that the size() may change based on what goes on in the loop.
}     // one by one element at at a time
```

Key ArrayList Methods: (where `a` is an ArrayList Object, see more in the Java API)

```
a.add(value) // appends value at end of list
a.add(index, value) // inserts given value just before the given index,
a.shifting  // subsequent values to the right
a.clear() // removes all elements of the list
a.indexOf(value)  // returns first index where given value is found in list
                  // (-1 if not found)
a.get(index) // returns the value at given index
a.remove(index)   // removes & returns value at given index,
                  // shifting subsequent values to the left
a.set(index, value) // replaces value at given index with given value
a.size() // returns the number of elements in list
a.toString()  // returns a string representation of the list such as "[3, -7, 15]"
a.addAll(list) OR a.addAll(index, list) // adds all elements from the given list to
          // this list (at the end of the list, or inserts them at the given index)
a.contains(value) // returns true if given value is found somewhere in this list
a.containsAll(list) // returns true if this list contains every element
                    // from given list
a.equals(list) // returns true if given other list contains the same elements
a.lastIndexOf(value) // returns last index value of value found in list
                     // (-1 if not found)
a.removeAll(list) // removes any elements found in the given list from this list
a.retainAll(list) // removes any elements not found in given list from this list
a.subList(from, to) // returns the sub-portion of the list between indexes
                    // from (inclusive) and to (exclusive)
a.toArray()  // returns the elements in this list as an array
```