

# AP Exam → Review and Preparation

## Concepts

- **De Morgan's Law**

- Distributing the !
  - $!(x \ \&\& \ y)$  is the same as  $!x \ || \ !y$
  - $!(x \ || \ y)$  is the same as  $!x \ \&\& \ !y$
  - $!(x > 0)$  is the same as  $x \leq 0$
  - $!(x < 0)$  is the same as  $x \geq 0$
- Shows how we can negate "and"s and "or"s
- Proving De Morgan's Law logically with truth tables:

A	B	A&&B	A  B	!A	!B	!(A&&B)
T	T	T	T	F	F	F
T	F	F	T	F	T	T
F	T	F	T	T	F	T
F	F	F	F	T	T	T

- Random number with Math class
  - Use the following formula for a random *int*...
    - `int x = (int) (Math.random()*(max-min)+1)+ min;`
  - Use the following formula for a random *double*...
    - `double y = (Math.random()*(max-min)+1)+ min;`
- Short circuit evaluation
  - `&&`
    - If the first is false, the whole expression is false; there is no point to check the rest
    - Used to check null, prevent runtime errors, dividing by zero
    - `false && false → false`
  - `||`
    - If first is true, the whole expression is true; there is no point to check the rest
- Compare methods
  - Compare To
    - `a.compareTo(b)` where *a* and *b* are Strings
    - Subtracts the lexicographic code of *a* and *b* as: *a-b* then returns said value

- Logical operators
  - Allows programs to make decisions based on multiple conditions
  - &&
    - If one is false, returns false
  - ||
    - If one is true, returns true
  - Boolean order of operations
    - 1) !
    - 2) &&
    - 3) ||
    - Order can be changed using parentheses
- Inheritance
  - All classes in Java inherit \_\_\_\_\_ from other classes
    - Attributes (instance variables)
    - Behaviors (methods)
- Constructors
  - If there are no constructors it will *not* error
    - If a class has no constructor in Java, the compiler will add a no-argument constructor
    - Creates a default empty constructor
  - Empty constructor
    - WILL NOT ERROR
    - A way to create an object without passing through specific parameters
    - Allows for the call `super()` ;
    - ALWAYS add an empty constructor when writing classes to avoid issues that may occur
  - Compile Time error
    - Occurs when a subclass has a no-argument constructor and variable is declared as `Class object = new SubClass();`

## Types of Errors

- `NullPointerException`
  - When a method calls something that contains a `null` value
- Compile Time error
  - Code does not run, crashes before it can go through code
  - Syntax errors
- Runtime error
  - Goes through the program but crashes while in progress
  - Prints anything before it errors
  - Calling `.equals(null)` causes a run-time error

## Sorting and Searching

- What to look for when deciding a sort/search...
  - Run-time efficiency
  - Size of the array
  - Amount of memory going to be used
- Searches
  - Sequential/Linear Search
    - Sequential way of searching through each elements until element is found
  - Binary Search
    - Examines the middle element and moves it left if element is less or right if element is greater
  - *Binary Searches are faster than Linear Searches*
- Sorting
  - Selection Sort
    - Selecting a value and putting it into its appropriate position in the list
    - Could swap a index value with greatest or smallest in array or list
  - Insertion Sort
    - Selects a value and compares it to the rest of the elements