CSE 1322
Module 2 – Part 3

Garbage and Static Keyword

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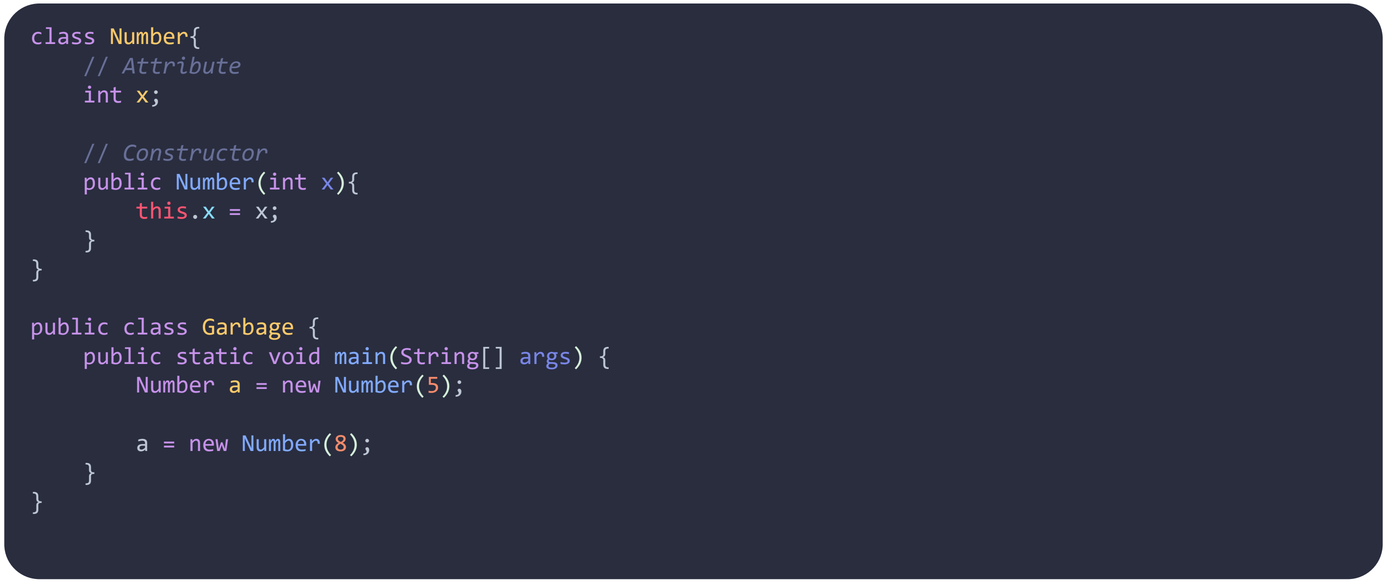
Garbage



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}
```

Memory (RAM)

address	value
0	
1	
2	
3	
4	

Week-4/Garbage-Static/Garbage.java

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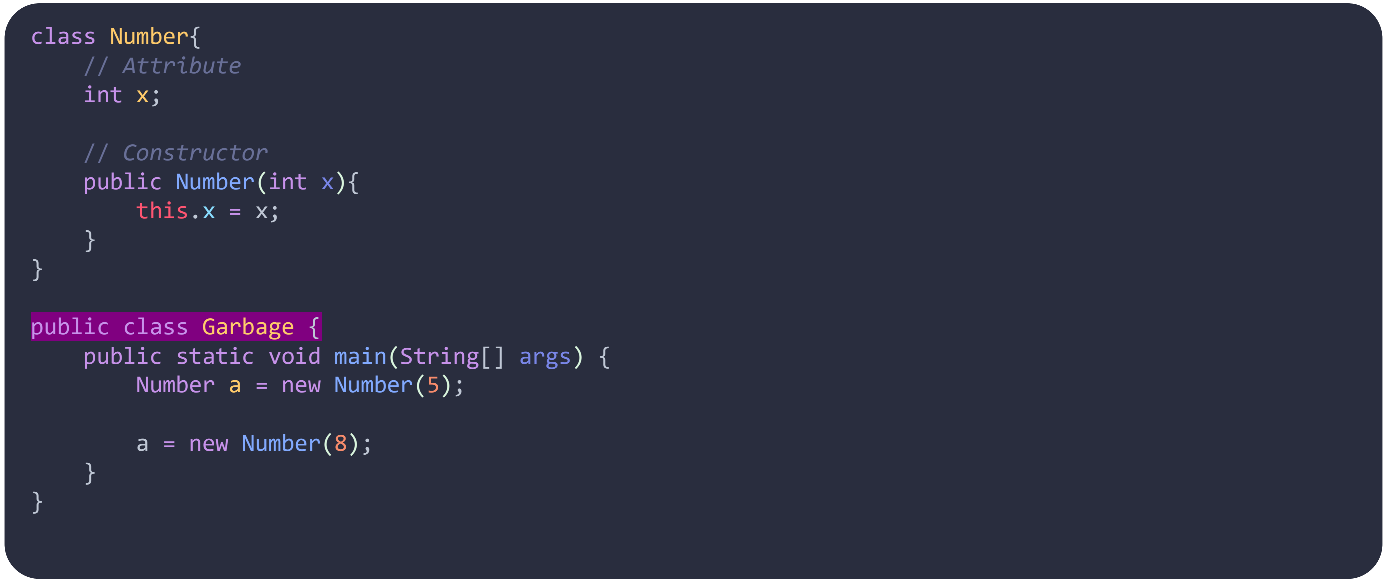
Garbage



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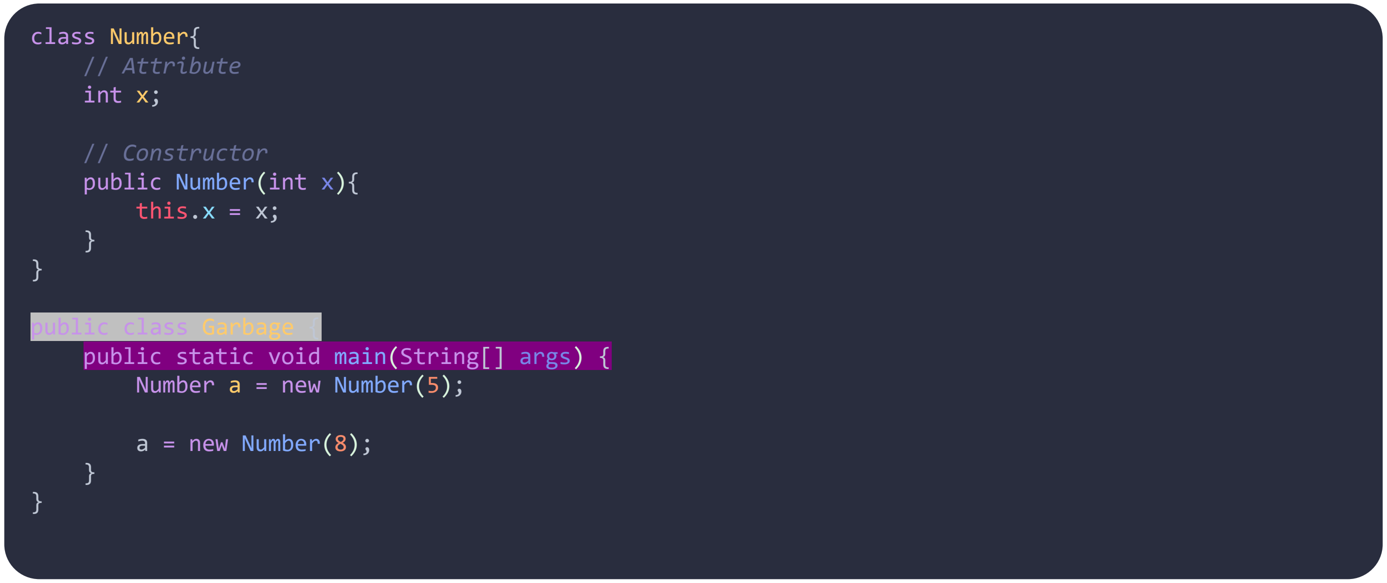

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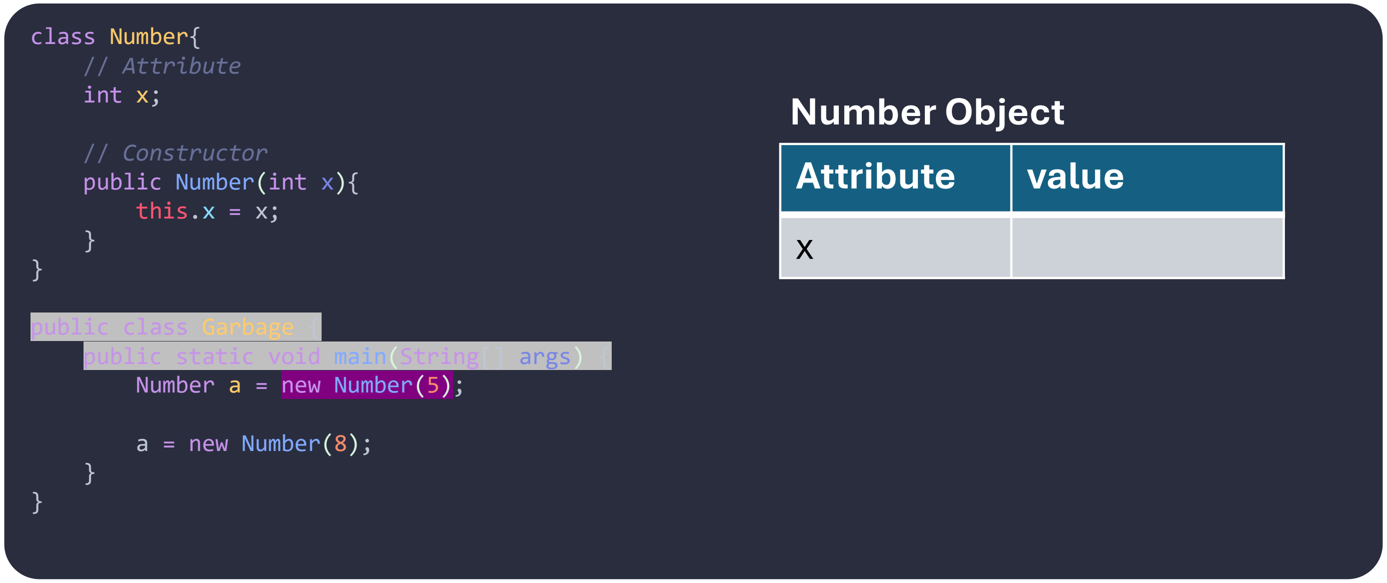

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Week-4/Garbage-Static/Garbage.java

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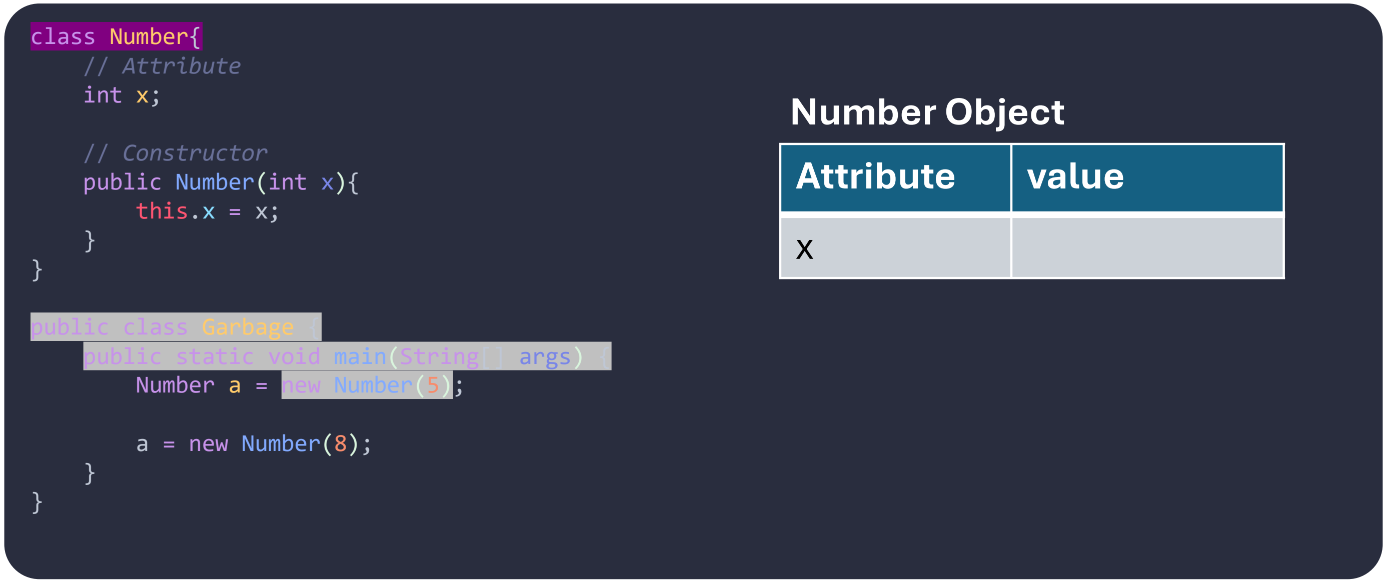

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Week-4/Garbage-Static/Garbage.java

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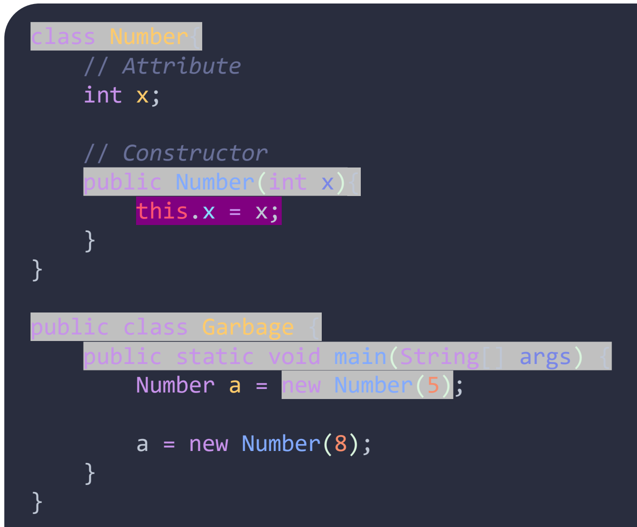

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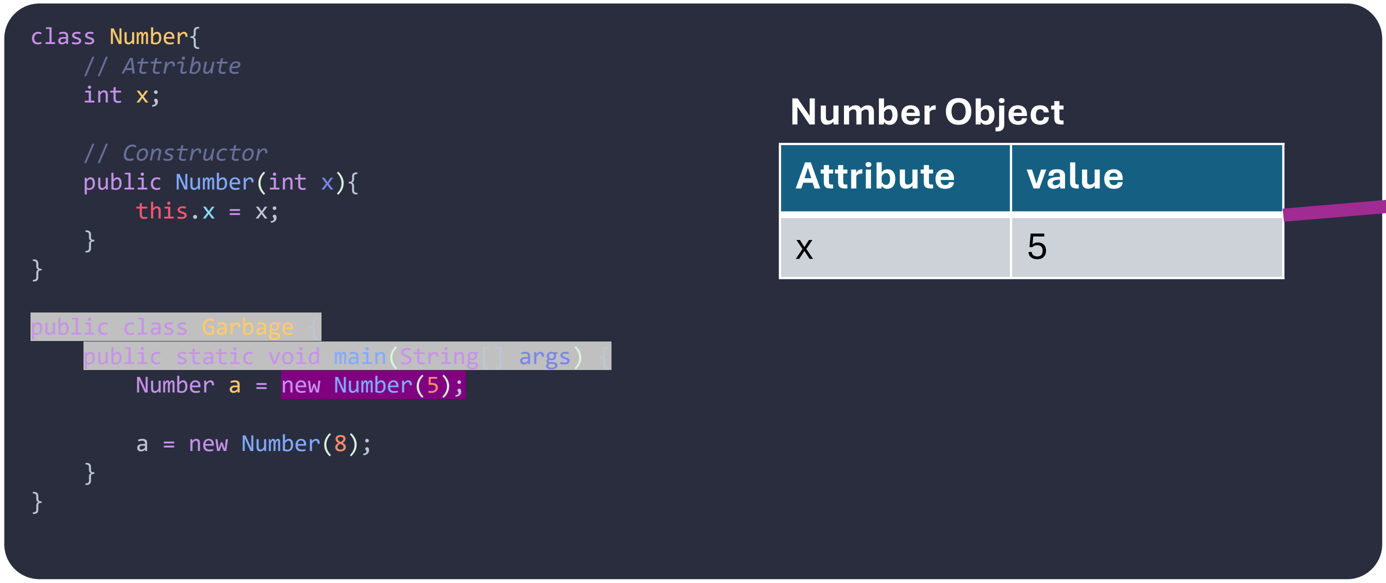

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Week-4/Garbage-Static/Garbage.java

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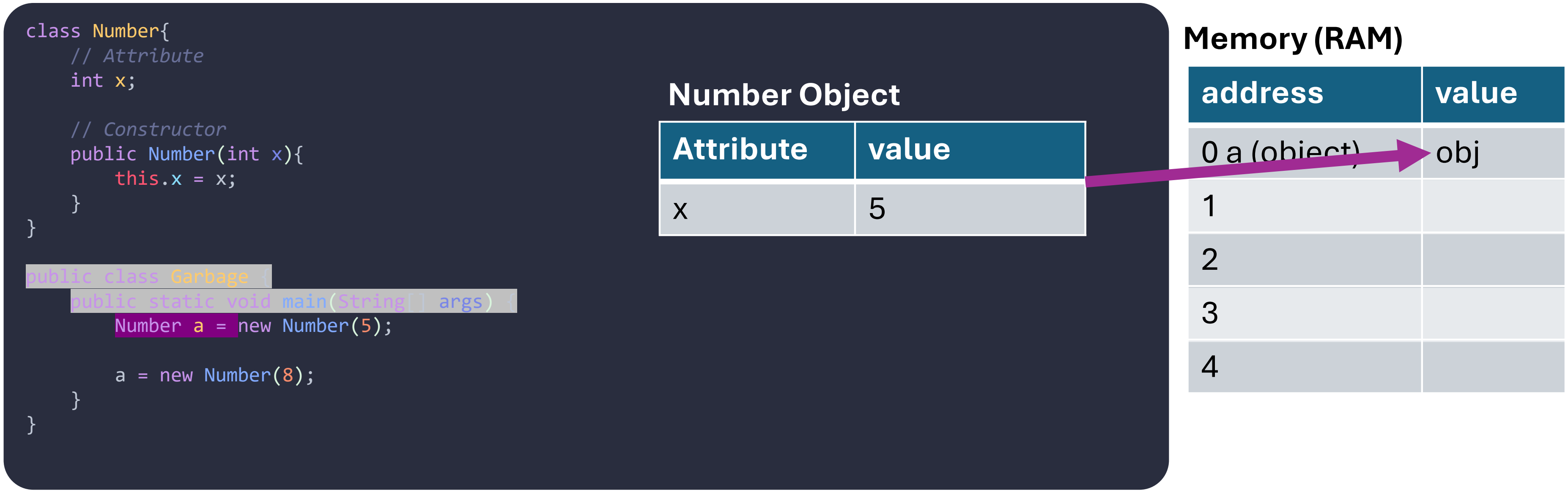

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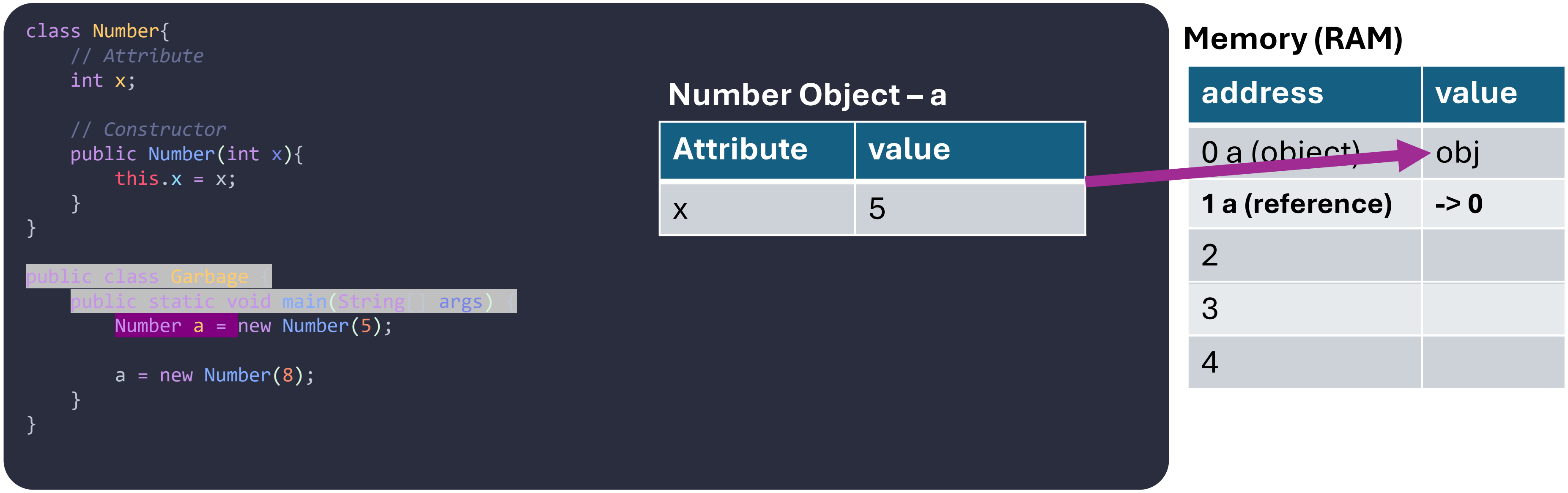

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Number Object – a

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Memory (RAM)

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Week-4/Garbage-Static/Garbage.java

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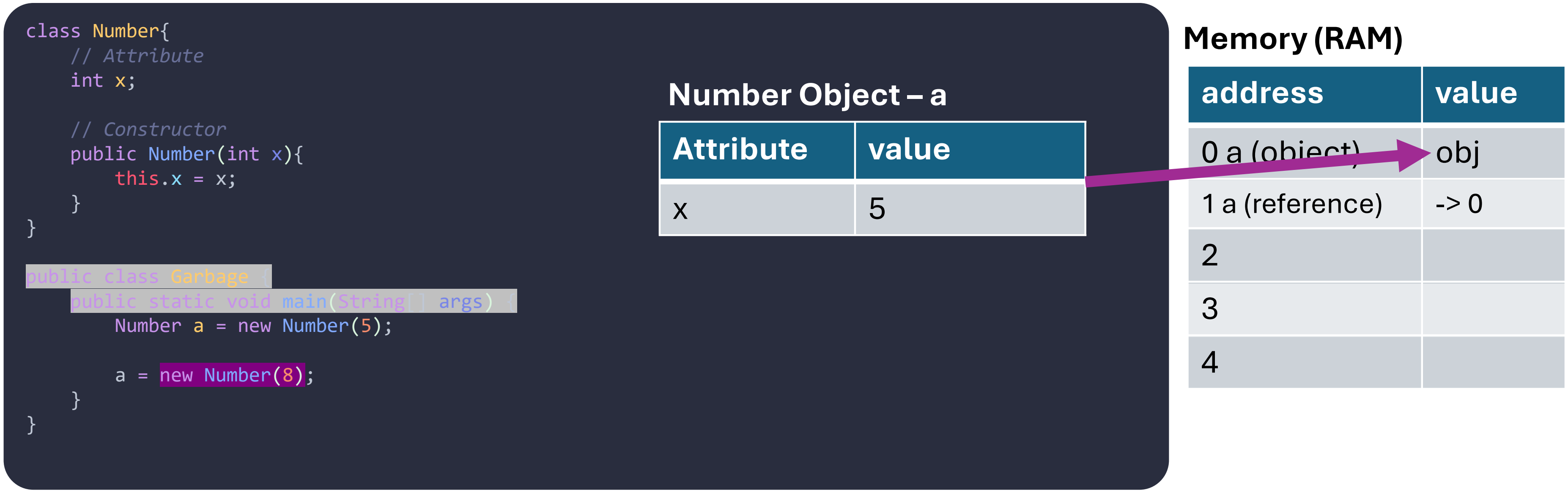

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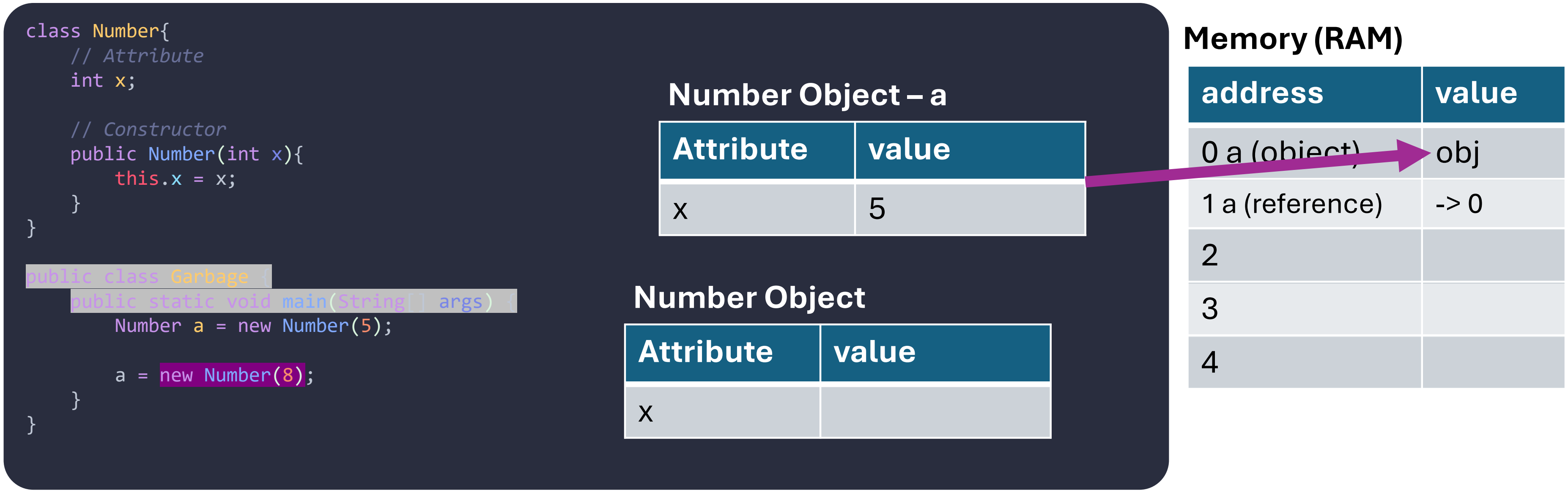

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Number Object

Attribute	value
x	

Memory (RAM)

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Week-4/Garbage-Static/Garbage.java

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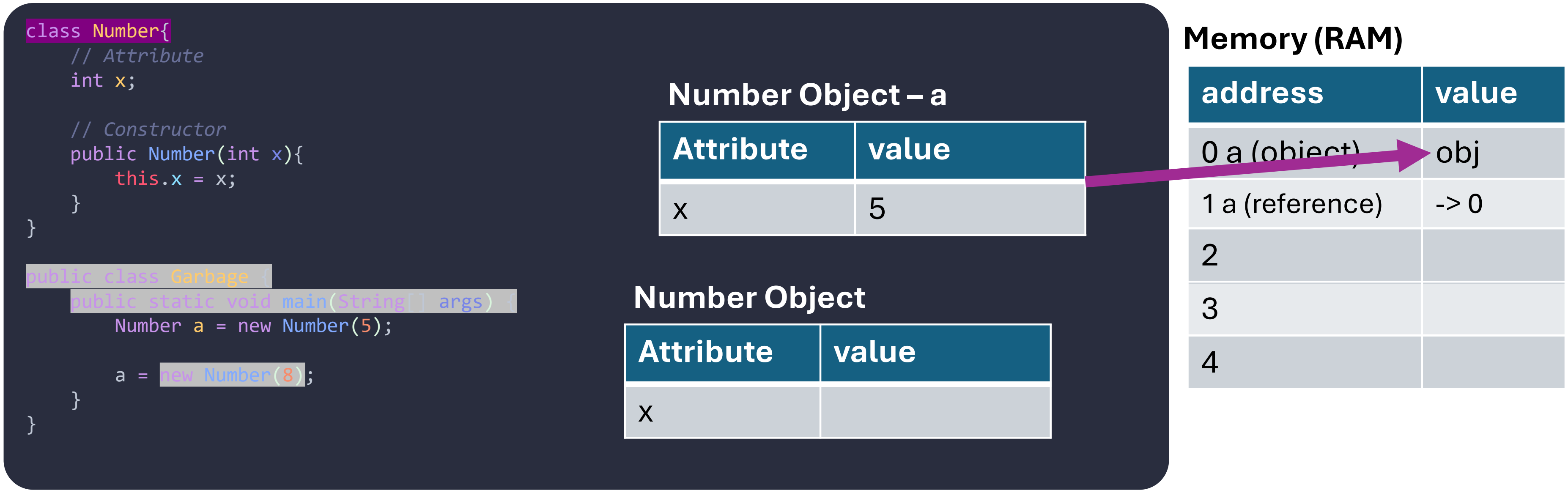

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Number Object

Attribute	value
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Memory (RAM)

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Week-4/Garbage-Static/Garbage.java

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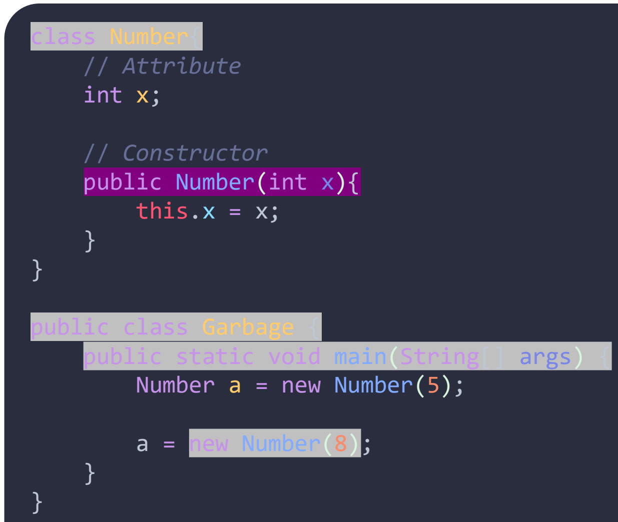

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Number Object – a

Attribute	value
x	5

Number Object

Attribute	value
x	

Memory (RAM)

address	value
0 a (object)	obj
1 a (reference)	-> 0
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Week-4/Garbage-Static/Garbage.java

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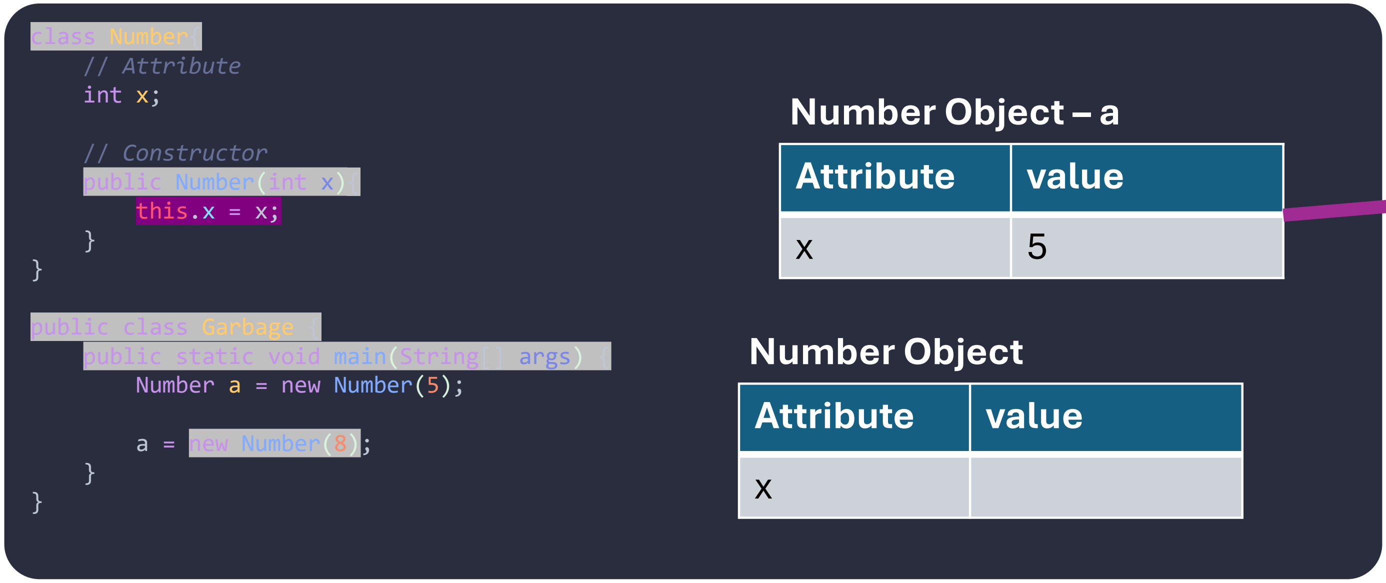
Garbage



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Number Object – a

Attribute	value
x	5

Number Object

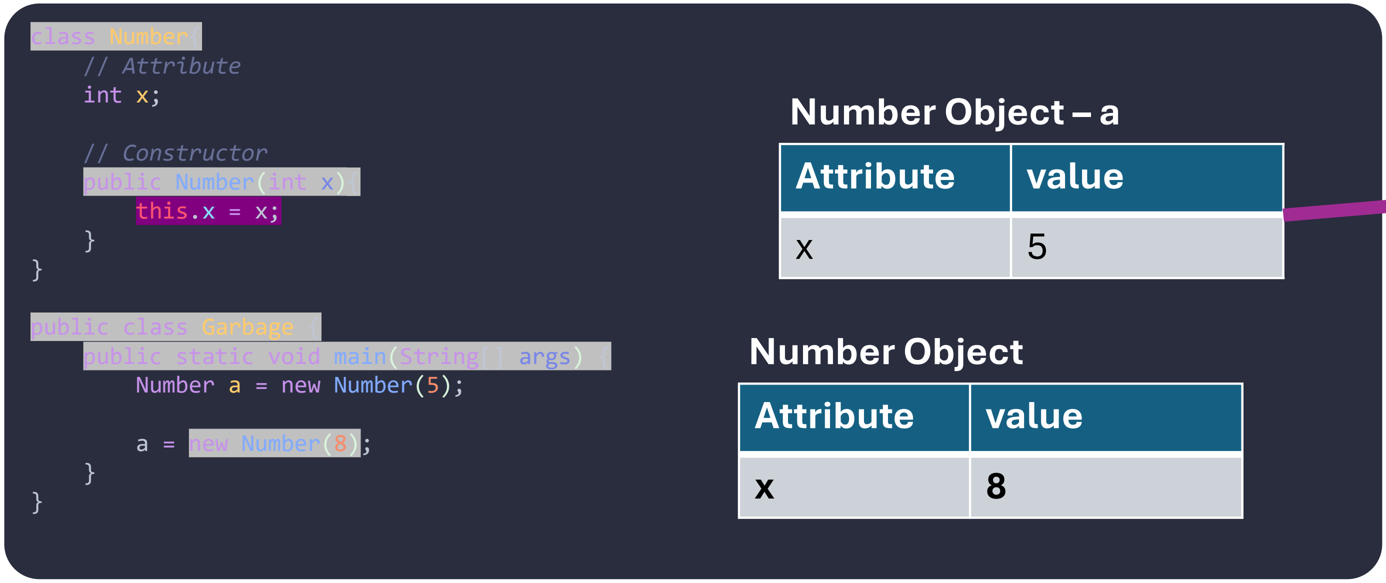
Attribute	value
x	

Memory (RAM)

address	value
0 a (object)	obj
1 a (reference)	-> 0
2	
3	
4	

Week-4/Garbage-Static/Garbage.java

Garbage



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Number Object – a

Attribute	value
x	5

Number Object

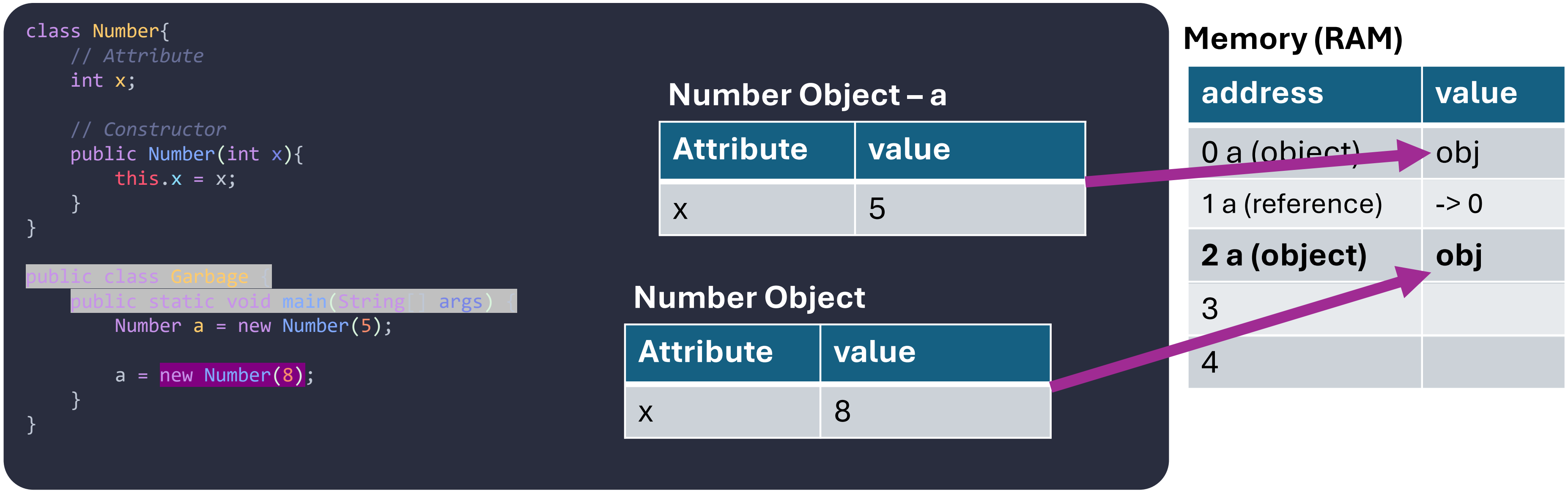
Attribute	value
x	**8**

Memory (RAM)

address	value
0 a (object)	obj
1 a (reference)	-> 0
2	
3	
4	

Week-4/Garbage-Static/Garbage.java

Garbage



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Number Object – a

Attribute	value
x	5

Number Object

Attribute	value
x	8

Memory (RAM)

address	value
0 a (object)	obj
1 a (reference)	-> 0
2 a (object)	**obj**
3	
4	

Week-4/Garbage-Static/Garbage.java

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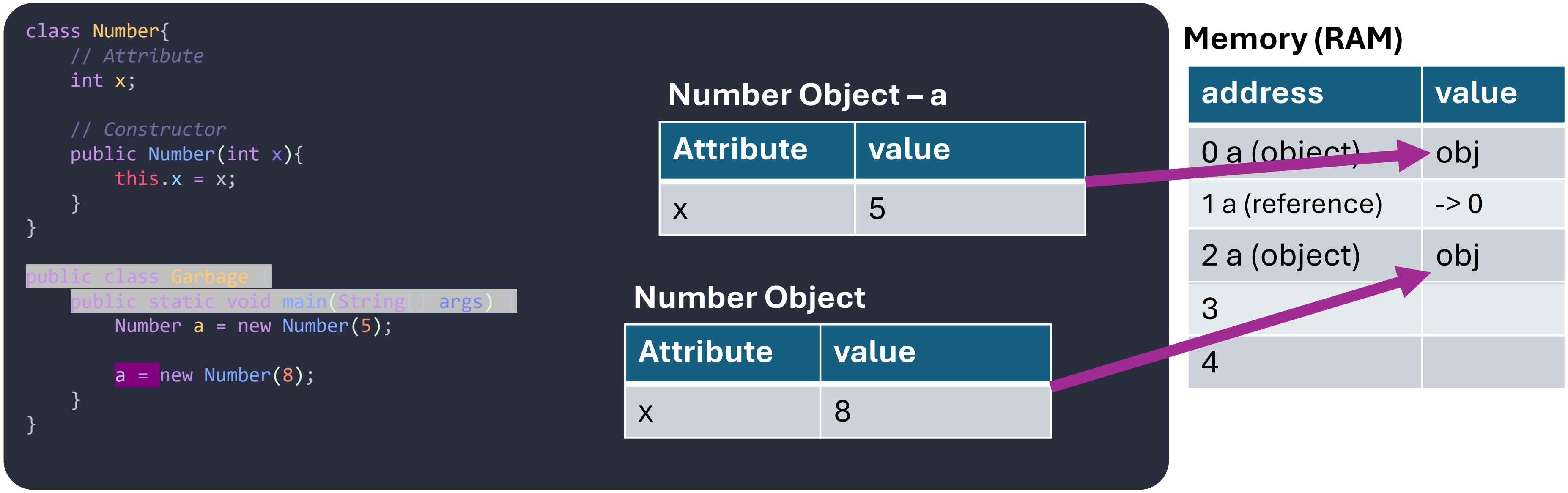

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Number Object – a

Attribute	value
x	5

Number Object

Attribute	value
x	8

Memory (RAM)

address	value
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1 a (reference)	-> 0
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Week-4/Garbage-Static/Garbage.java

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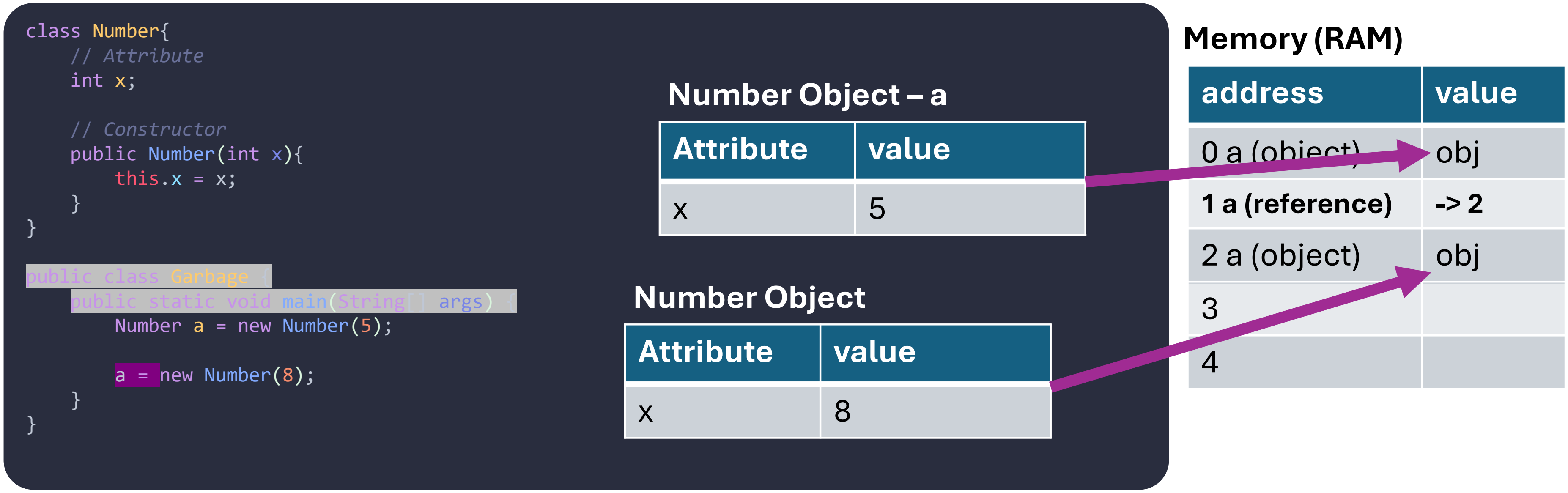

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Number Object – a

Attribute	value
x	5

Number Object

Attribute	value
x	8

Memory (RAM)

address	value
0 a (object)	obj
1 a (reference)	**-> 2**
2 a (object)	obj
3	
4	

Week-4/Garbage-Static/Garbage.java

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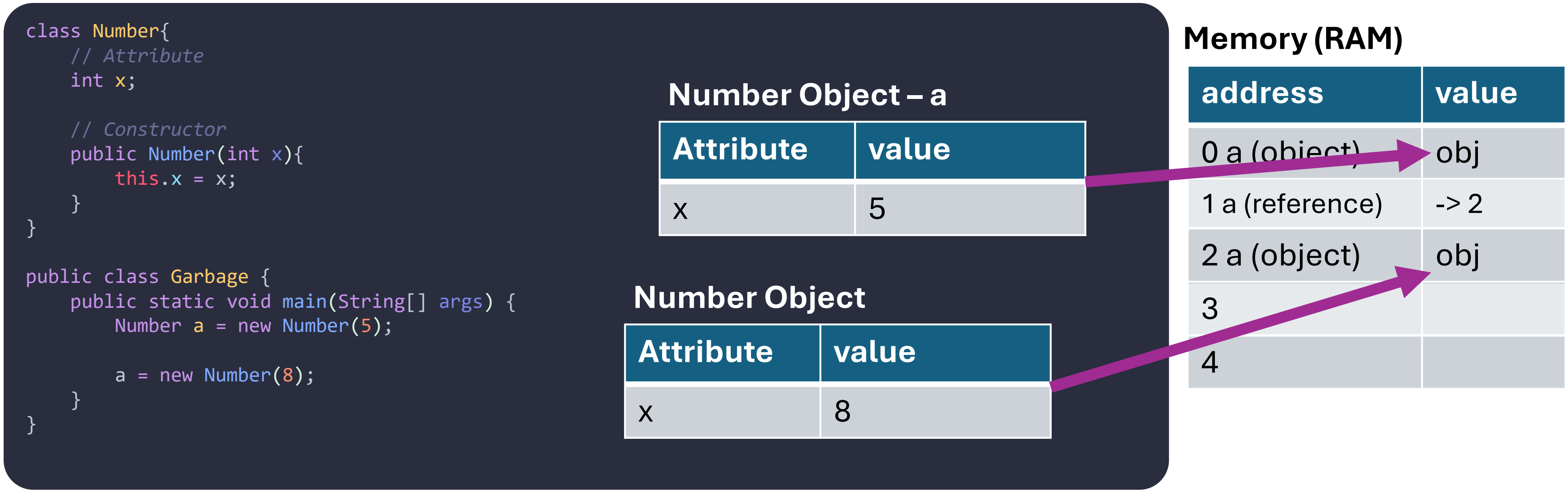

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Number Object – a

Attribute	value
x	5

Number Object

Attribute	value
x	8

Memory (RAM)

address	value
0 a (object)	obj
1 a (reference)	-> 2
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3	
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Week-4/Garbage-Static/Garbage.java

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Garbage

- The object at address **0** is no longer being referenced by any variable.
- This means that **a** is now considered **Garbage**.
- At some point during the runtime or by the end of the program, the object at address **0** will be deleted by Java Garbage Collector.

Memory (RAM)

address	value
0 a (object)	**obj**
1 a (reference)	-> 2
2 a (object)	obj
3	
4	

Garbage

- The Java Garbage Collector is a task that runs in the background.
- The purpose of the JGC is to clean up unused memory addresses.
  - In this case, since there is nothing that references **address 0**, it is **unreachable** and cannot be used. Therefore, it will ***eventually get removed***.

Memory (RAM)

address	value
0 a (object)	**obj**
1 a (reference)	-> 2
2 a (object)	obj
3	
4	

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Garbage

- We say “**eventually removed**” because it is not guaranteed when the garbage collection will happen.
- **Address 0** it is just **eligible** for Garbage Collection.

Memory (RAM)

address	**value**
0 a (object)	**obj**
1 a (reference)	-> 2
2 a (object)	obj
3	
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Garbage

- Garbage Collection is just another task that runs in the background; hence it uses resources.
- Having the Garbage Collector run aggressively is great for memory efficiency, but it drives a higher CPU utilization and add unnecessary overhead.

Memory (RAM)

address	value
0 a (object)	**obj**
1 a (reference)	-> 2
2 a (object)	obj
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Static

- The static keyword is used to mark anything that belongs to the class rather than the instance (object).
- We can have:
  - Static Variables
  - Static Methods
  - Static Classes

Static

Feature	Static (Class-Level)	Instance (Object-Level)
Belongs to	The class itself	Each individual instance
Requires Object?	NO	YES
Can use .this	NO	YES
Changes affect	All instances	Individual instance

Static – Variables and Methods

- Variables and Methods marked as **static** are shared across all instances.
- They should be called using class name.
  - Calling static variables or methods using the instance name is possible, but they should be called with the class name since they “belong to the class” not the instance.
- Cannot use **this** since it belongs to the class, not the instance.

Static – Methods

- Static methods can access any static variable or function from within the class.
- They cannot access non-static values directly.
    - If you need to access a non-static value, you must either pass an object of the same class or create an instance of the same class from within the function.

Static – Class

- In Java, we can create static classes, but they must be nested inside a class, they cannot be “top-level” classes.
- Static classes can only access static members of the outer class.
- We are not going to discuss this yet, but there are lots of use cases for this.

Static – Example

- Let’s build a software for a car dealership.
- We want a program that keeps track on all salesman from a car dealership.
- We need to know their basic information such as first and last name.
- We also want to track how many cars the dealership has sold in total and how many cars each salesman has sold.
- From within the program, a salesman should be able to increase the number of cars they have sold.

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Static – Example: Salesman Class

- To build this program, we will follow these constraints:
  - We can only have 2 classes, the Driver and a Salesman class.
  - The Salesman Class will contain the data related to a salesman such as first and last name and how many cars that salesman has sold (individual sales).
  - The Salesman Class will contain a static variable to keep track on the total amount of cars sold by every salesman in the dealership.
  - The Salesman Class will contain a static function to print back the total amount of cars sold and the report of how many cars were sold by which salesman.

Static – Example: Driver

- For the driver:
  - The dealership has 3 salesmen; therefore, we need an array of Salesman class of size 3.
  - In a loop, we prompt the user if they want to add a sale or print a report of sales.
  - If the user chooses to add a sale, we ask which salesmen.
  - If the user chooses print a report, we will call the report function and finish the program.