# Tinker Academy

## AP Computer Science Prep (Java Programming)
## Lecture 2 - DataTypes, Variables & Refs (Variables)

Winter 2015

# Variables

# Lecture 2 - Types, Variables & Refs

## Variables

- Sometimes we need to keep track of a value
- Example, speed of a car
- The value could change

# Lecture 2 - Types, Variables & Refs

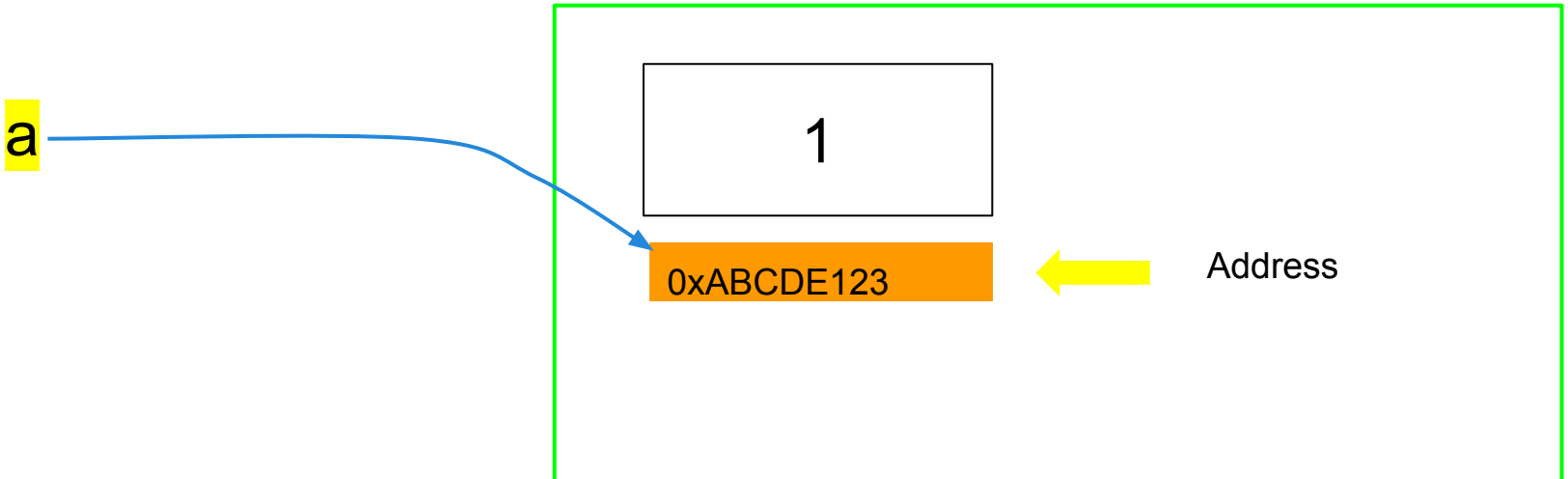
## Variables

- Java has concept of a variable
- Used to keep track of a value that can vary

# Lecture 2 - Types, Variables & Refs

## Variables

- are actually named locations in memory
- a is a named location in memory
- address of the location is 0xABCDE123



# Lecture 2 - Types, Variables & Refs

## Variables

- are named storage locations
- point to the storage location in memory
- location can never be changed (unlike C/C++ pointers)
- value stored at location
- value can be changed
- always has a value

# Lecture 2 - Types, Variables & Refs

## Variables

- have a name
- name is case sensitive (case matters)
- name is a String (sequence of characters)
- first character of name should not be digit
- the value can be changed

# Declaring Variables

# Lecture 2 - Types, Variables & Refs

Variables have associated data types

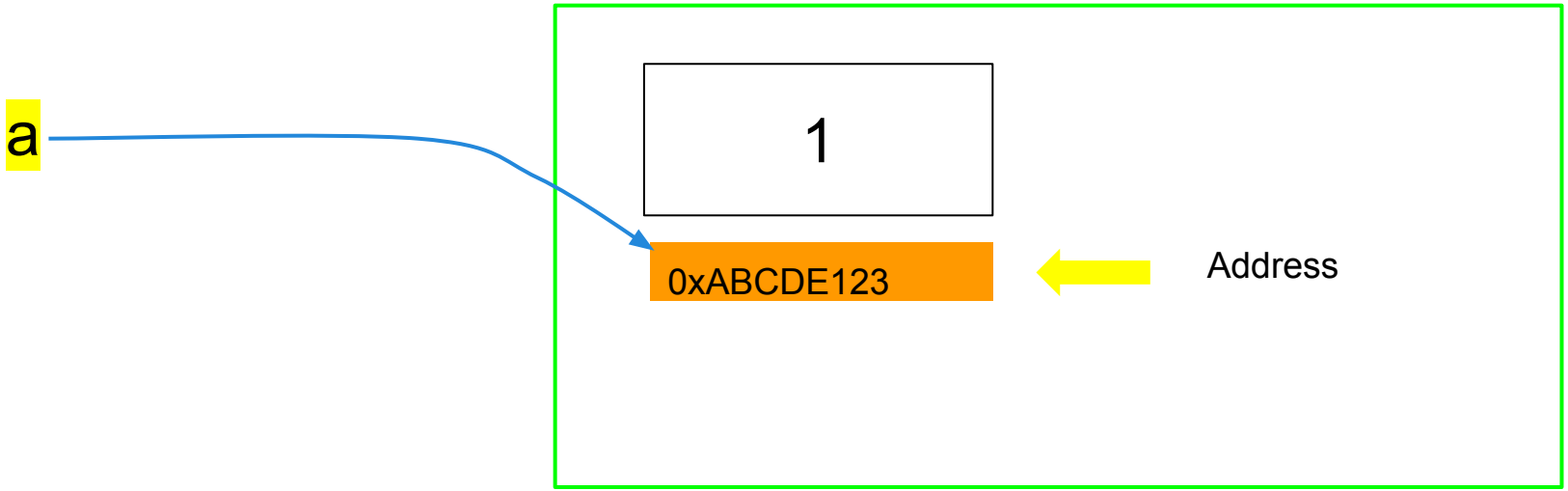
```
int a;
```

- Primitive DataType
- Reference DataType
- Special Datatype String

# Lecture 2 - Types, Variables & Refs

## Variables with Primitive DataType

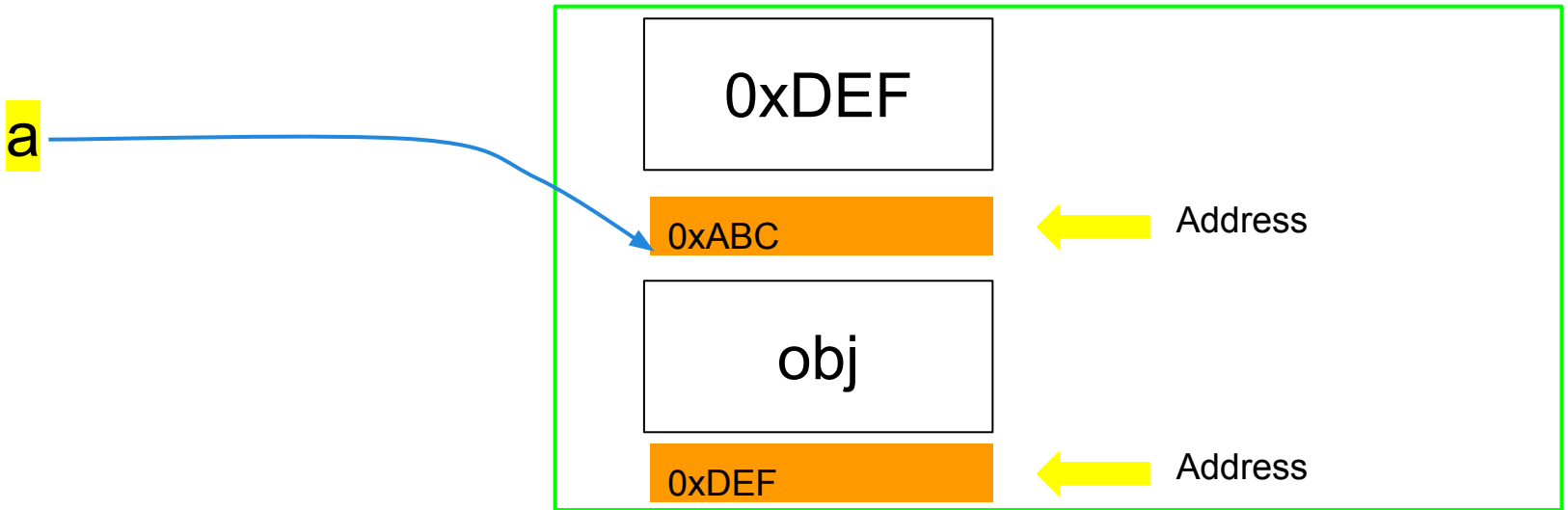
- value is a valid value for the data type



# Lecture 2 - Types, Variables & Refs

## Variables with Reference DataType

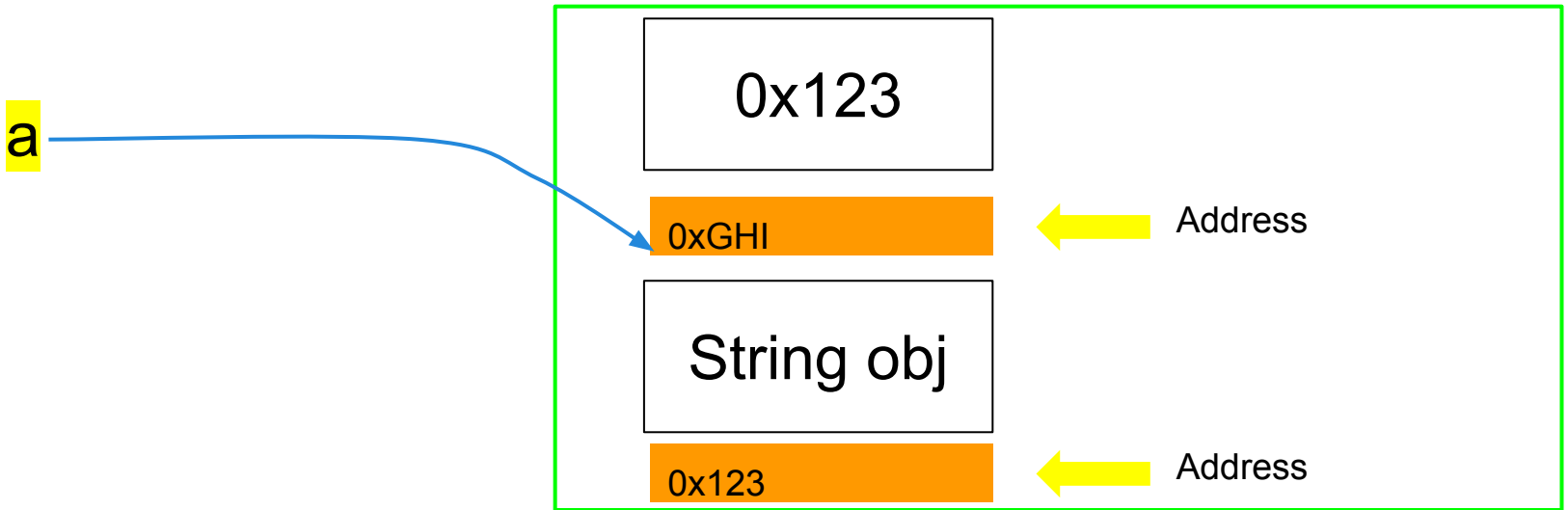
- value is a reference to an object OR
- a special value null (which indicates no reference)



# Lecture 2 - Types, Variables & Refs

## Variables with String DataType

- value is a reference to an String object OR
- a special value null (which indicates no reference)



# Lecture 2 - Types, Variables & Refs

Variables always have an associated value

| Variable | Name | Datatype | Value |
|---|---|---|---|
| int a; | a | int | 0 (default value) |

*Java Virtual Machine does not specify size of boolean, conceptually we are treating it here as 1 byte

# Lecture 2 - Types, Variables & Refs

## Declaring Variables

- variables need to be **declared** before use
- the datatype of the variable is specified during declaration
- the datatype of the variable can never change (Java is a statically typed language)

# Lecture 2 - Types, Variables & Refs

## Data Type Storage

| Name | Storage required | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| int | | | | | | | | |
| long | | | | | | | | |
| byte | | | | | | | | |
| short | | | | | | | | |
| float | | | | | | | | |
| double | | | | | | | | |

# Lecture 2 - Types, Variables & Refs

## Data Type Storage

| Name | Storage required | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| char | | | | | | | | |
| boolean* | | | | | | | | |
| reference** | | | | | | | | |
| String** | | | | | | | | |

*The Java language does not specify size of boolean explicitly - conceptually its 1 byte
** reference data types refer to objects and require varying size depending on the underlying class

# Lecture 2 - Types, Variables & Refs

## Declaring Variables

- the datatype indicates the amount of storage required
- if the initial value is not specified then variable gets a “default value”

# Default Value

# Lecture 2 - Types, Variables & Refs

## Default Value

| Variable | Datatype | Default Value |
|---|---|---|
| int a; | int | 0 |
| long a; | long | 0 |
| byte a; | byte | 0 |
| short a; | short | 0 |
| float a; | float | 0 |
| double a; | double | 0 |

*Java Virtual Machine does not specify size of boolean, conceptually we are treating it here as 1 byte

# Lecture 2 - Types, Variables & Refs

## Default Value

| Variable | Datatype | Default Value |
|---|---|---|
| char a; | char | 0 |
| boolean a; | boolean | False |
| Object a; | Object | null |

*Java Virtual Machine does not specify size of boolean, conceptually we are treating it here as 1 byte

# Initial Value

# Lecture 2 - Types, Variables & Refs

## Assigning an initial value

```
int a = 1;
```

*Java Virtual Machine does not specify size of boolean, conceptually we are treating it here as 1 byte

# Lecture 2 - Types, Variables & Refs

## Assigning an initial value

| Variable | Datatype | Initial Value |
|---|---|---|
| int a = 1; | int | 1 |
| long a = 1L; | long | 1 |
| byte a = 1; | byte | 1 |
| short a = 1; | short | 1 |
| float a = 1.0f; | float | 1.0 |
| double a = 1.0; | double | 1.0 |

*Java Virtual Machine does not specify size of boolean, conceptually we are treating it here as 1 byte

# Lecture 2 - Types, Variables & Refs

## Variables have associated data types

| **Variable** | **Datatype** | **Initial Value** |
|---|---|---|
| char a = ‘C’; | char | ‘C’ (number code |
| boolean a =  True; | boolean | True |
| Object a = null; | Object | null |
| Object a = new Object(); | Object | object of type Object |
| MyJavaClass a = new MyJavaClass(); | MyJavaClass | object of type MyJavaClass |

*Java Virtual Machine does not specify size of boolean, conceptually we are treating it here as 1 byte

# Lecture 2 - Types, Variables & Refs

## Initial Value

- initial value specified as part of declaration
- if the initial value is not specified then variable gets a “default value”
- Variables with Reference Datatypes can have a special value **null** which means the variable does not have a real reference (yet)

# Assigning a new Value

# Lecture 2 - Types, Variables & Refs

## Variables have associated data types

| Variable | Datatype | Initial Value | New Value |
|---|---|---|---|
| a = 2; | int | 1 | 2 |
| a = 2L; | long | 1 | 2 |
| a = 2; | byte | 1 | 2 |
| a = 2; | short | 1 | 2 |
| a = 2.0f; | float | 1.0 | 2.0 |
| a = 2.0; | double | 1.0 | 2.0 |

*Initial Value was specified in an earlier side

# Lecture 2 - Types, Variables & Refs

## Variables have associated data types

| Variable | Datatype | Initial Value | New Value |
|---|---|---|---|
| a = ‘D’; | char | ‘C’ (number code 67) | ‘D’ (number code 68) |
| a = False; | boolean | True | False |
| a = null; | Object | null | null |
| a = new Object(); | Object | object of type Object | another object of type Object* |
| a = new MyJavaClass(); | MyJavaClass | object of type MyJavaClass | another object of type MyJavaClass* |

*the old objects are eventually destroyed by the JVM

# Lecture 2 - Types, Variables & Refs

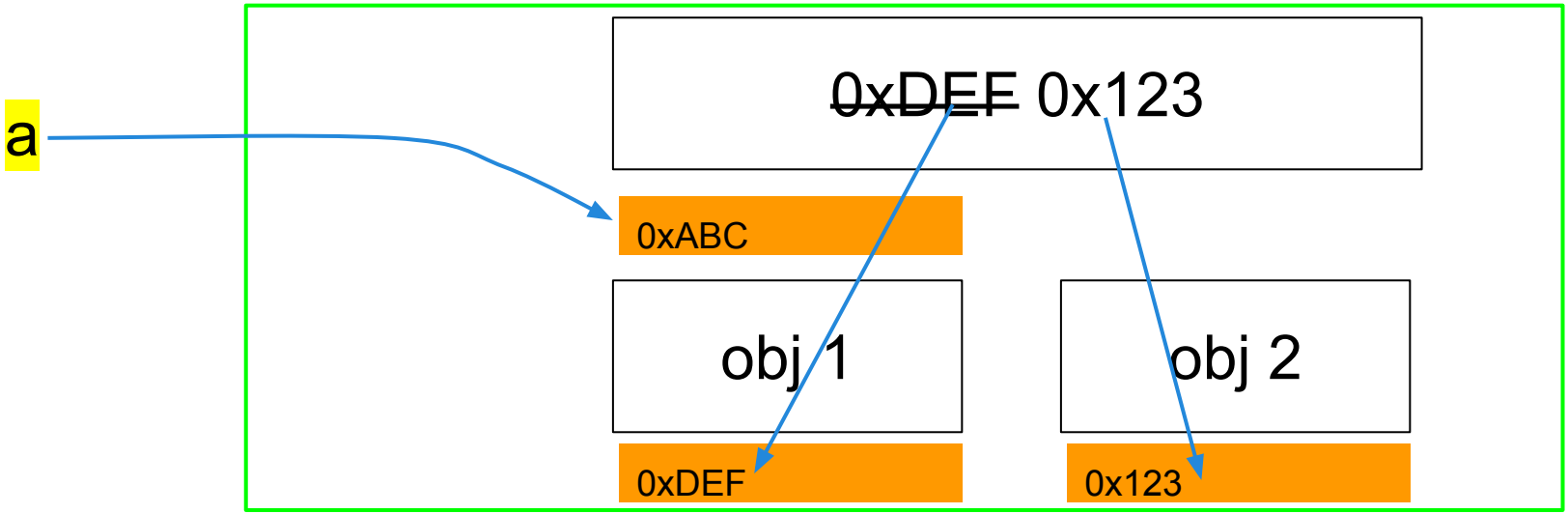
## Assigning a new Value

- new value specified by using an assignment statement
- new value can be the special value **null** indicating that the variable no longer points to a object reference
- new value gets replaces the old value

# Lecture 2 - Types, Variables & Refs

## Assigning a new Value

- new reference value replaces old reference value



# Lecture 2 - Types, Variables & Refs

## Assigning a new Value

- new value specified by using an assignment statement
- new value can be the special value **null** indicating that the variable no longer points to a object reference
- new value gets replaces the old value
- **if** the old value is an object reference, **and** the object has no other references to it, the object is eventually gets destroyed by the JVM