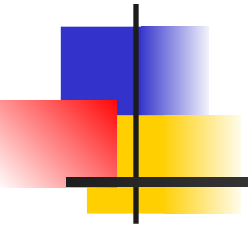


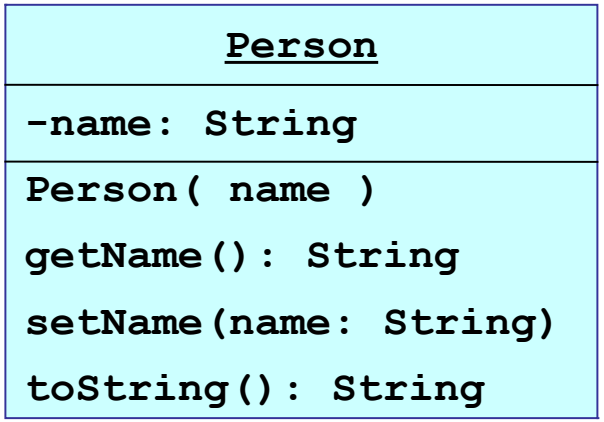
Object References

James Brucker

Example

```
Person a = new Person("Ant");
Person b = new Person("Nok");
System.out.println(a); // "Ant"
b = a;
a.setName("Bat");
System.out.println(a); // "Bat"

// what is printed?
System.out.println(b);
```



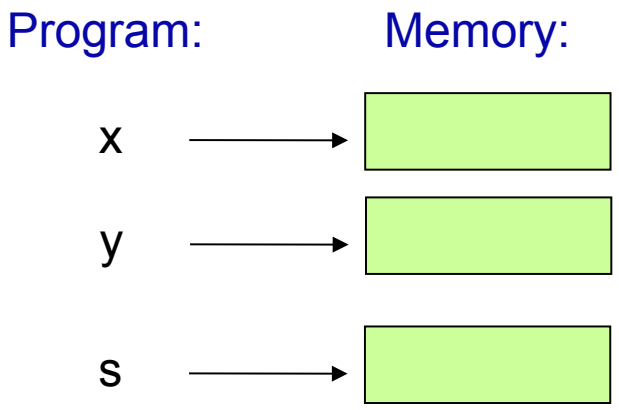
UML Class Diagram shows the attributes and methods of a class.

Variables

A variable is a name we use to *refer* to a memory location.

What is stored in the memory location?

```
/* define two variables */
int x;
int y;
String s;
```



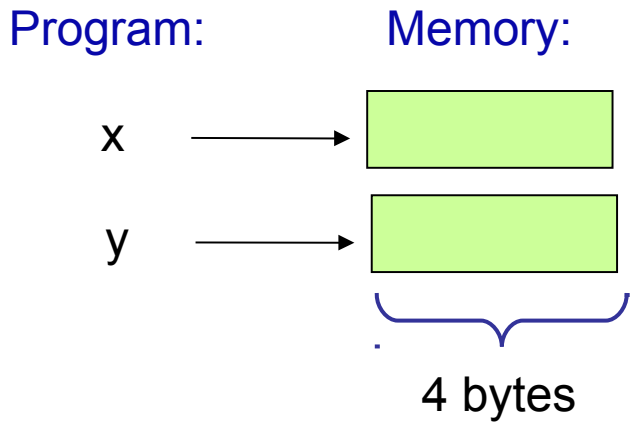
We will see that the answer is ***different*** for variables of primitive data types and variables of *object* data types.

This is important -- know it!

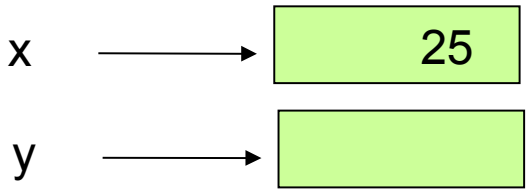
Primitive Data Types are stored as values

For primitive data types, the variable's memory location holds its value.
Data types for which this is true are called **value data types**.

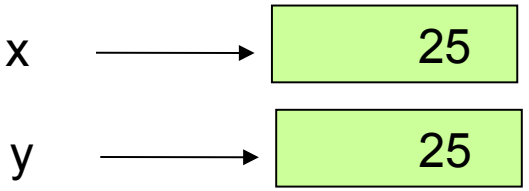
```
/* define two "int"
  variables */
int x;
int y;
```




```
/* assign value to x */
x = 25;
```



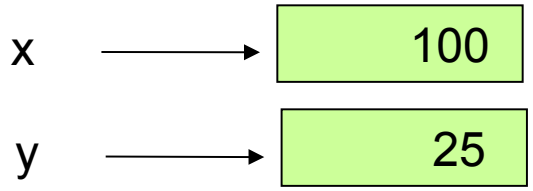

```
/* assign value to y */
y = x;
```



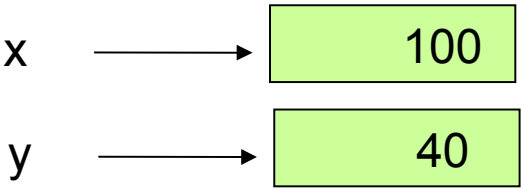
Values are copied on assignment

Changing the value of x does not affect the value of y.

```
x = 100;
```



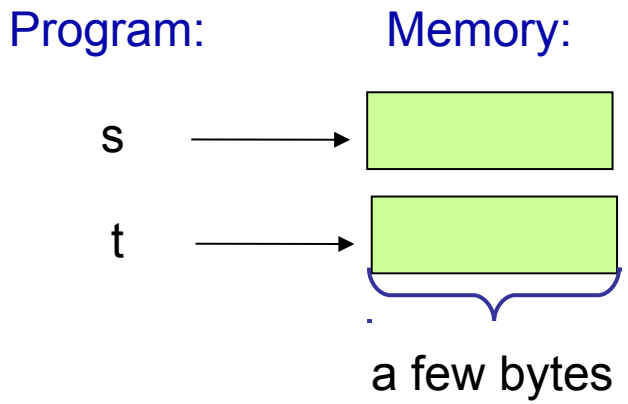

```
/* assign value to y */
y = 40;
```



Variables for Object Data Types

For object data types, a variable is a ***reference*** to the object, but does not store the object !!

```
/* define two String
  variables */
String s;
String t;
```

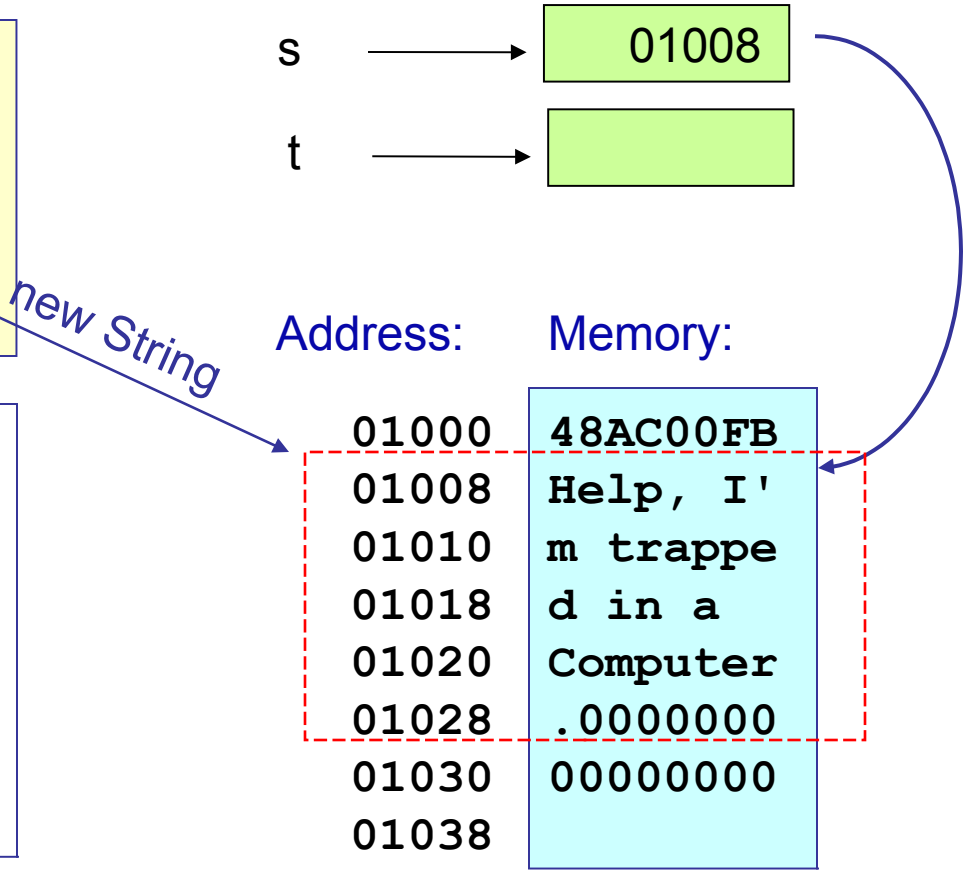


Variables refer to the Object's location

To *create* an object you must use the "new" keyword.

This allocates new storage in a memory region called the heap.

```
String s;
/* create an object */
s = new String("Help,
  I'm trapped in a
  Computer.");
```



The new command creates a new object and returns a *reference* to its memory location

The object also contains other information, such as:

- length of string
- the Class it belongs to

Variables refer to an Object's location

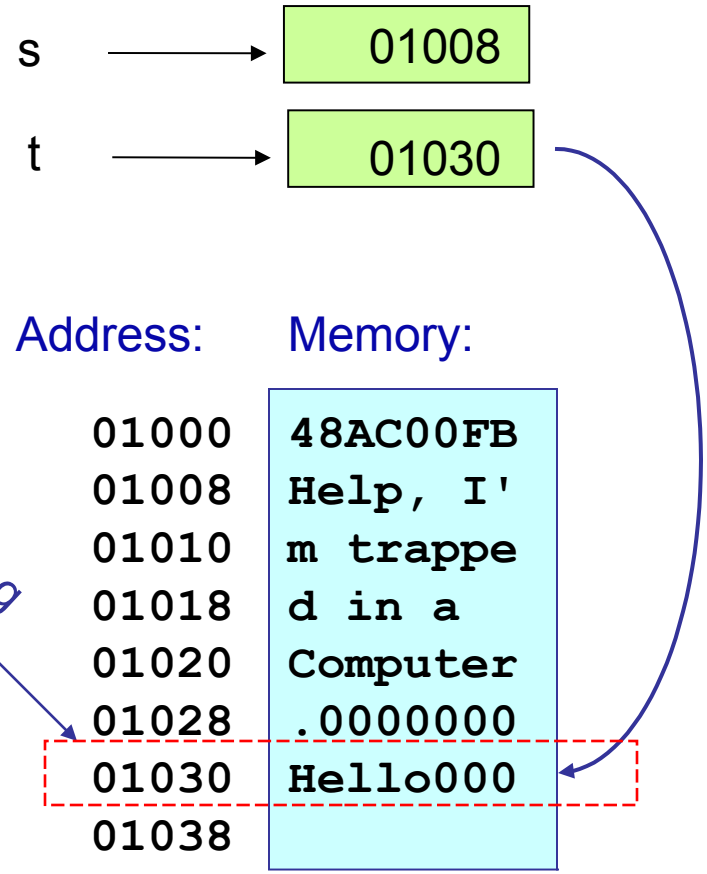
Each new object gets its own storage space on the heap.

The size of the object can be anything.

```
/* create an object */

t = new String("Hello");
```

The new command finds some more free "heap" space large enough for the String "Hello".
It creates a String object and returns a *reference* to it.



Variables for Object Data Types (4)

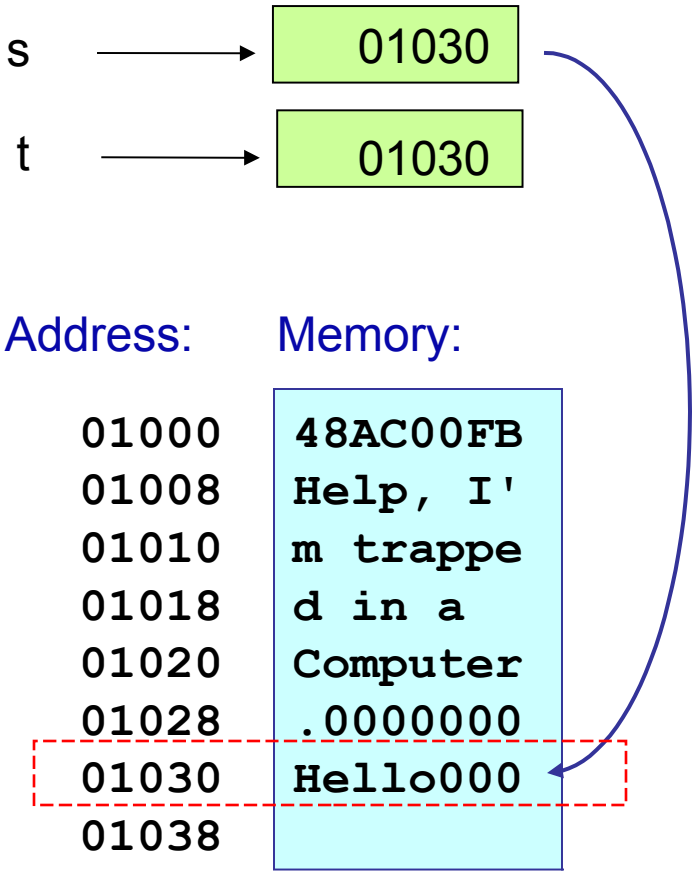
When you *assign a value* to a reference variable, you are assigning the ***address*** of the object -- not the object's value!

```
// copy object reference
s = t;
```

Now `s` refers to the same object as `t ("Hello")`.

The old String object has no reference ... it is garbage.

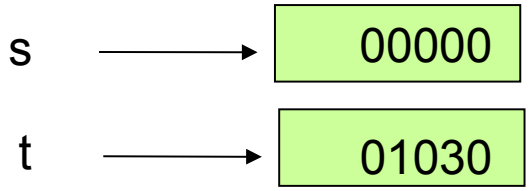
Eventually Java will reclaim the storage space for re-use.



The null value

If an object variable (object reference) doesn't refer to any object, it is assigned a value of null. You can use this to "clear" a reference.

```
/* discard old value */
s = null;
```



Address: Memory:

Address	Memory
01000	48AC00FB
01008	Help, I'
01010	m trappe
01018	d in a
01020	Computer
01028	.0000000
01030	Hello000
01038	

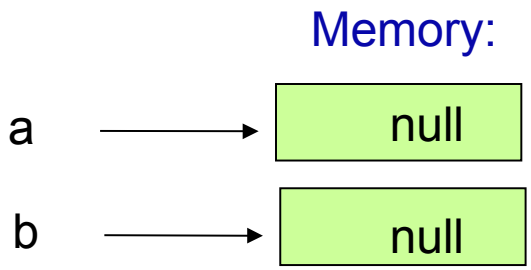
Now **s** does not refer to anything.

But, the old value may still be in memory (in the heap).

Another Example: BankAccount (1)

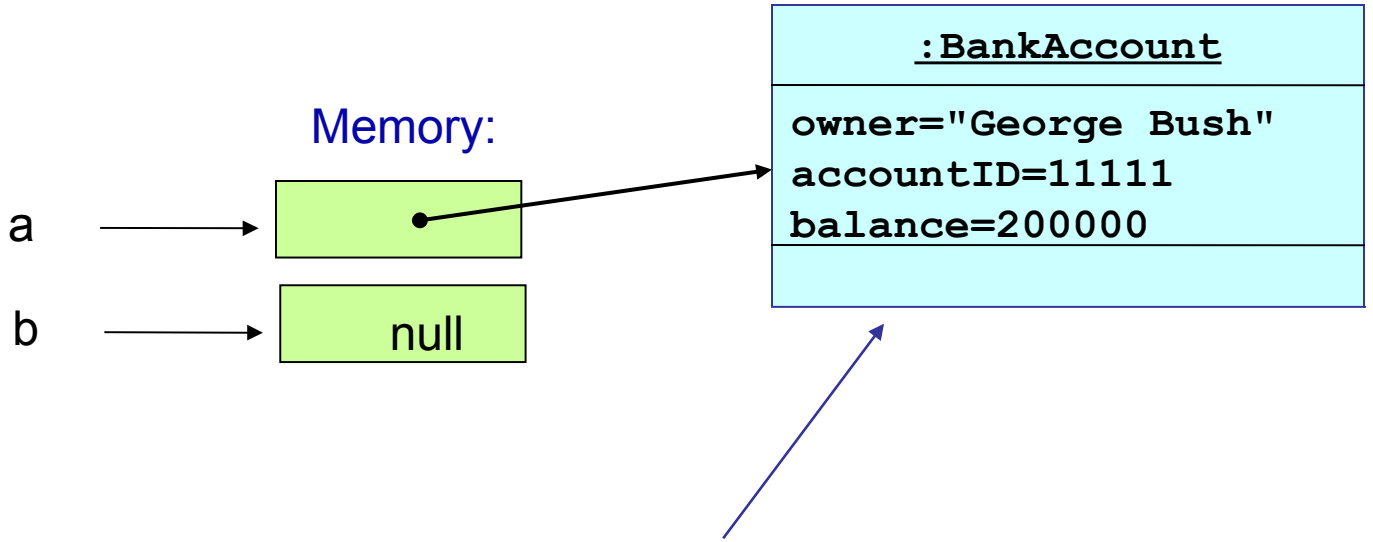
```
BankAccount a;
BankAccount b;
```

This creates BankAccount *references*, but doesn't create any BankAccount *objects*.



BankAccount (2)

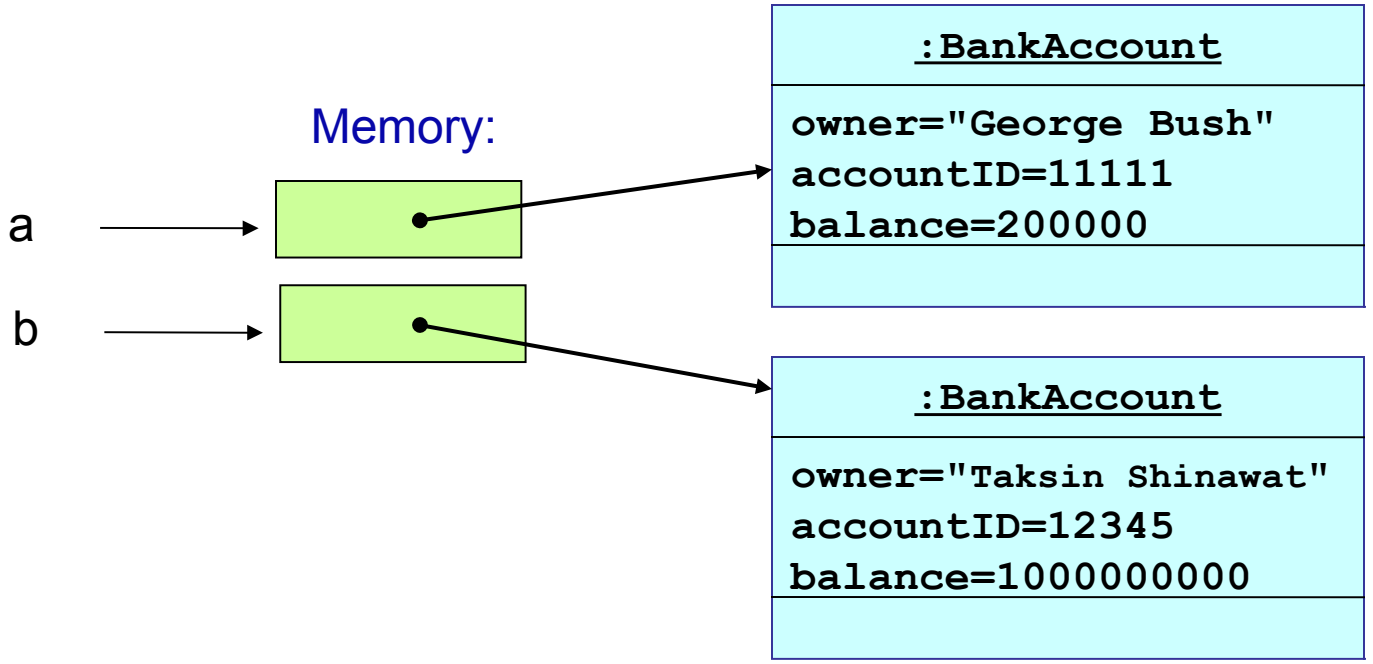
```
a = new BankAccount( "George Bush", 11111);
a.deposit(200000);
```



UML ***Object Diagram*** notation, show the values of one object..

Create another BankAccount

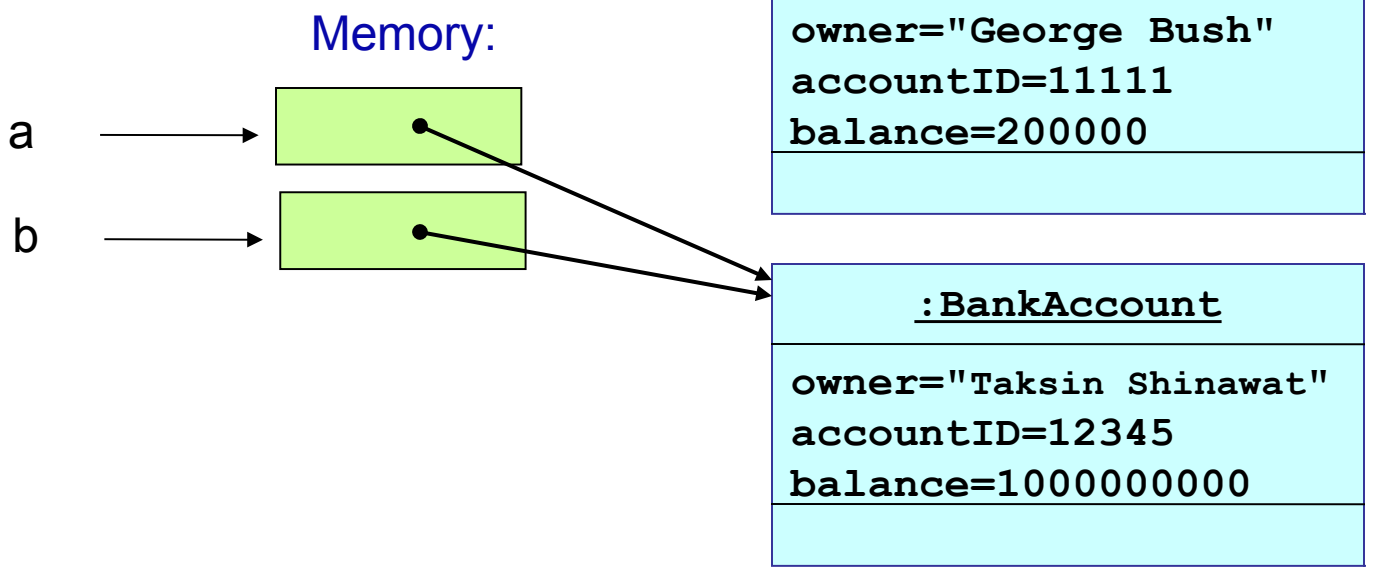
```
b = new BankAccount( "Taksin Shinawat", 12345);
b.deposit(1000000000);
```



assign a: copy or reference?

```
// copy Taksin's data into the other object?
a = b;
```

No copy! It makes **a** "point to" the same object as **b**.



Who's Got the Money?

```
// copy Taksin's data into the other object?
a = b;
a.setOwner("Donald Trump");
```