Method Calls in Java

First, some information about the Stack, local variables & parameters

- The Stack keeps the state of all active methods
  (those that have been invoked but have not yet completed)

- When a method is called a new stack frame for it is added to the top of the stack, this stack frame is where space for the method's local variables and parameters are allocated

- When a method returns, its stack frame is removed from the top of the stack (space for its local vars and params is de-allocated)

- Space for local variables and parameters exist only while the method is active (it has a stack frame on the Stack)

- local variables and parameters are only in scope when they are in the top stack frame (when this method's code is being executed)

An Example

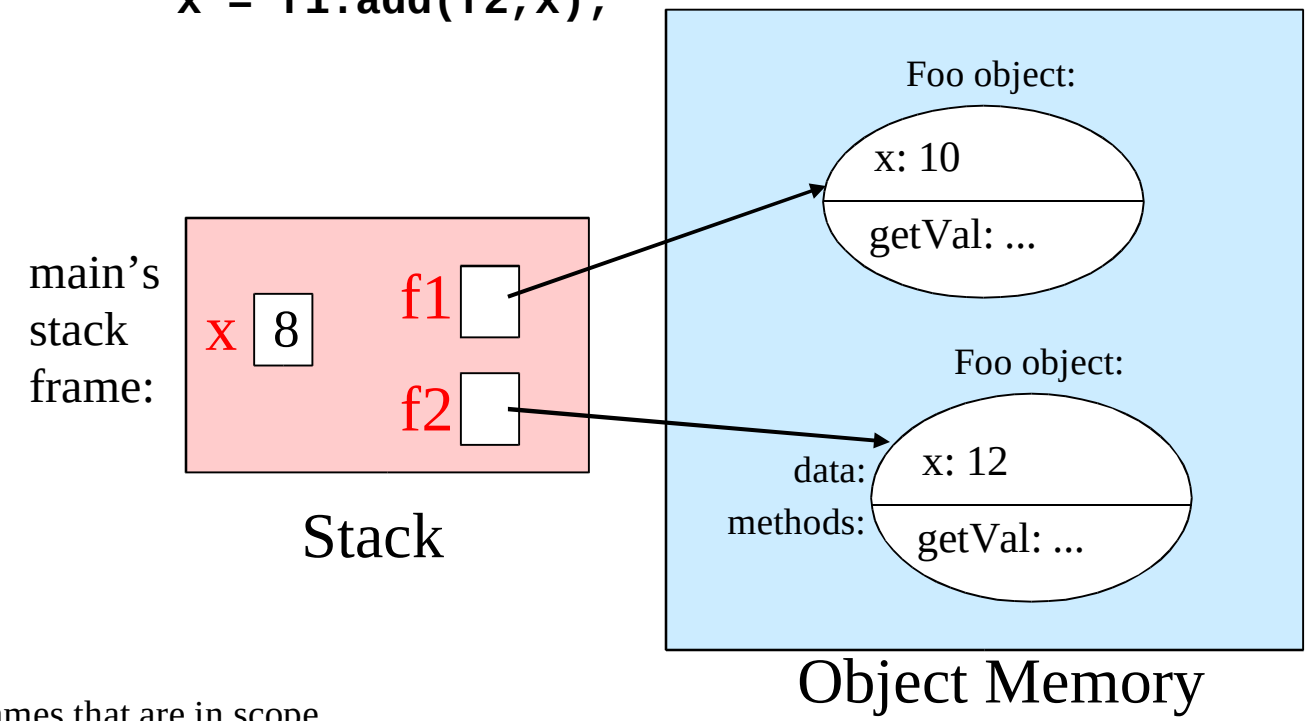
```
public class TestMethodCalls {
       public static void main(String[] args) {
              Foo f1, f2;
              int x=8;
              f1 = new Foo(10);
              f2 = new Foo(12);
              f1.setVal(x);
              x = f1.add(f2, x);
       }

public class Foo {
       private int x;
       public Foo(int val) { x = val; }
       public void setVal(int val) { x = val; }
       public int  getVal() { return x; }
       public int plus(Foo f, int val) {
              int result;
              result = f.getVal() + x + val;
              return result;
       }
}
```

We start executing code in main:

- there is a single stack frame containing main's local variables

```
public class TestMethodCalls {
        public static void main(String[] args) {
          Foo f1, f2;
          int x =8;
          f1 = new Foo(10);
          f2 = new Foo(12);
          f1.setVal(x);
          x = f1.add(f2,x);
}
```



Only through variables f1 *and* f2 *can* main *access the objects' public members*

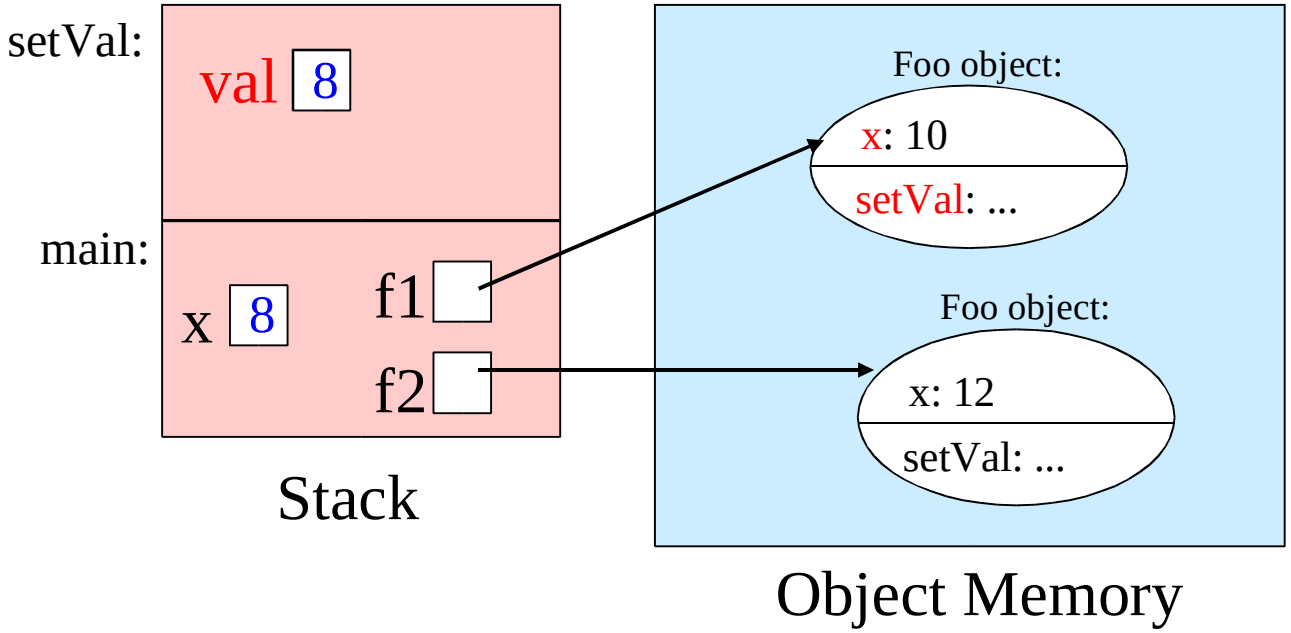
: names that are in scope

When main calls f1's setVal method a new stack frame is added that holds setVal's parameters and local variables

```
public class TestMethodCalls {
        public static void main( …) {
                …
                f1.setVal(x);
}
```

```
public class Foo {
        private int x;
        public void setVal(int  val){
                x = val;
        }
```

Parameter val gets its value from its argument (the value of x in main)



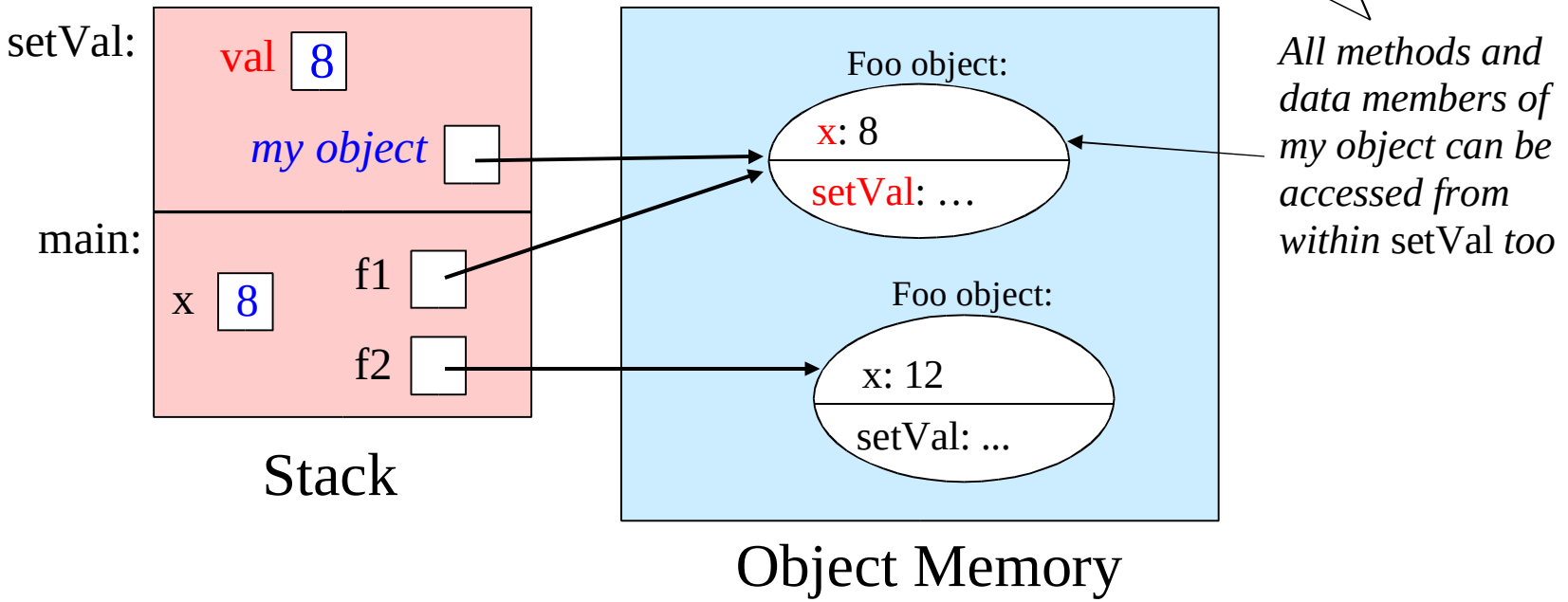
Implicitly, a reference to the object referred to by f1 is passed as well:

- setVal is called from within this object, so its members are in scope as well as all parameters and local variables of setVal

```
public class TestMethodCalls {
        public static void main( …) {
                …
                f1.setVal(x);

}
```

```
public class Foo {
        private int x;
        public void setVal(int  val){
         // set data member x's value
           x = val;
        }
        public add(Foo f, int x) { …
```



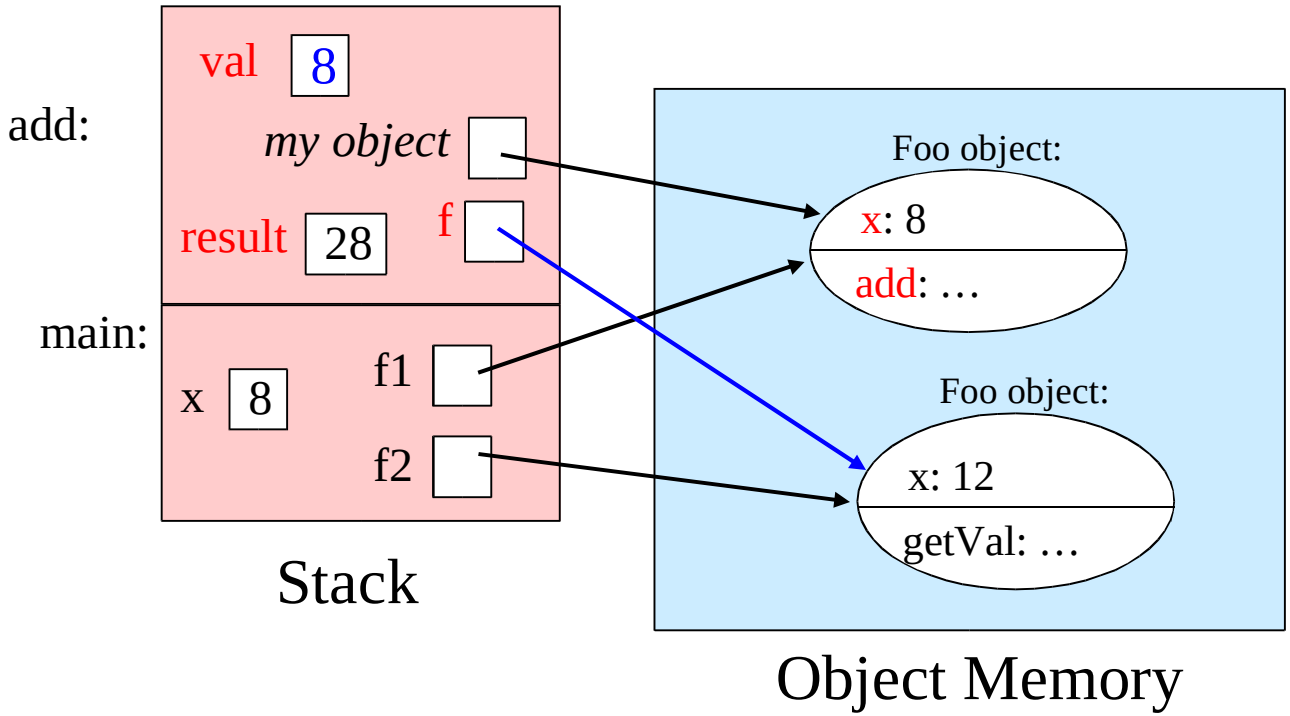
When main calls add, we are passing the value of object ref f2:

- add's parameter f refers to the same object as f2 does

```
public class TestMethodCalls {
        public static void main( …) {

                . . .
          x = f1.add(f2, x);
```

```
public class Foo {
     private int x;
     public int plus(Foo f, int val) {
        int result;
        result = f.getVal() + x +val;
        return result;
      }
```



If a method changes the value of a parameter, it does not change the argument's value:

```
public class TestMethodCalls {
        public static void main( …) {

                . . .
          x = f1.add(f2, x);
```

```
public class Foo {
     private int x;
     public int plus(Foo f, int val) {
        int result = 0;
        f = new Foo(6);
        val = 20;
        return result;
      }
```