Example of the use of the back door in a synchronized object

Class C, to the right, illustrates how a thread can use the back door to a synchronized object and change that object even when another thread is synchronized on it.

Look first at method m. Its body is synchronized on static variable y. Here is what m does.

1. Print a message.
2. Sleep for 3 seconds. This gives another thread time to get in the back door.
3. Print a message that it woke up.
4. Add 1 to y.
5. Print a message that it added 1 to y.

Now look at method run, a call of which takes place in a different thread from method m. Here is what run does — notice the two commented out lines around the assignment to y; we’ll discuss them later.

1. Print a message.
2. Sleep for 1 second. This is to ensure that the call on method m will be executed before this method changes y.
3. Print a message that it woke up.
4. Set y to -100.
5. Print a message that it set y to -100.

Method main is called to start the program. It creates an instance of the class and stores it in r, creates an instance of Thread with r as argument, and call its method start. This results in a call on method run. Then method m is called. Methods run and m, are running simultaneously in two different threads.

Below to the left, we show what the program prints. Method run changed y even though method m had synchronized on y — run used the back door.

Now, look at the two commented lines surrounding the assignment \( y = -100 \); in method run. Uncomment those lines and the assignment to y becomes synchronized on y. Run the program again, and it prints the output shown in the box to the right below. You can see that method run had to wait until after method m completed its synchronized block before changing y.

We urge you to download this code from JavaHyperText and run this program yourself; it will help your understanding to do this.

```java
/** This class illustrates that a thread can use the back door and change a variable even though another thread has synchronized on that variable. */
public class C implements Runnable {
    static Integer y= 2;

    public static void main(String args[]) {
        Runnable r= new C();
        new Thread(r).start();
        m();
        System.out.println("Ending. y is: "+y);
    }

    /** Add 1 to y, synchronizing on y to do it.
     * Print a message when starting, after waking up, and after changing y. */
    public static void m() {
        synchronized (y) {
            System.out.println("m starting");
            try {
                Thread.sleep(3000);
            } catch (InterruptedException e) {
            }
            System.out.println("m woke up");
            y= y + 1;
            System.out.println("m added 1 to y.");
        }
    }

    /** Sleep for 1 second, then set y to -100.
     * Print a message when starting, after waking up, and after changing y. */
    public @Override void run() {
        System.out.println("run starting");
        try {
            Thread.currentThread().sleep(1000);
        } catch (InterruptedException e) {
        }
        System.out.println("run: y set to -100");
        // synchronized (y) {
        y= -100;
        // }
        System.out.println("run: y set to -100");
    }
}
```

Method run uses the back door

```
m starting; it's synchronized on y
run starting
run woke up
run: y set to -100
m woke up; it's synchronized on y
m added 1 to y.
m releasing the lock
Ending. y is: -99
```