

# Program Execution

November 25, 2008

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## What is a Computer?

- ◁ Monitor
- ◁ Keyboard
- ◁ Mouse
- ◁ Hard drive
- ◁ CD/DVD drive
- ◁ Memory



[http://www.iusb.edu/~cted/summer/  
img/Computer.JPG](http://www.iusb.edu/~cted/summer/img/Computer.JPG)

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## What parts of Computer does a Program Use the Most?

- Central Processing Unit (CPU)
  - Executes **instructions** ← Java statements
  - 2.16 GHz means 2.16 billion instructions per second
- Memory
  - Holds **data** ← Java variables
  - 1 GB means 1 billion bytes

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## What is Program Execution?

- Java statements:
  - Modify memory
    - Assignment statements (=)
    - Increment and decrement statements (++ , --)
    - Parameter passing (calling methods and constructors)
    - Object construction (new)
  - Determine which statement to execute next (aka control flow)
    - Next in method
    - If or while condition
    - For loop
    - Call a method or constructor

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# Variables and Memory

- A variable declaration "allocates memory"
- Type tells it how much memory to allocate
- Reserves that memory for that variable

int row;



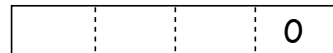
- 4 bytes for an int
- 8 bytes for a double

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# Assignment Statement

- Puts a value into the memory of the variable being assigned to

row = 0;

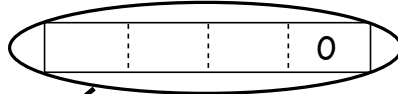


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# Assignment Statement

- Puts a value into the memory of the variable being assigned to

row = 0;



- Using a variable uses the value in the memory associated with the variable

while (row < 6) {...}

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# Assignment Statement

- Puts a value into the memory of the variable being assigned to

row = 0;



- Using a variable uses the value in the memory associated with the variable

while (row < 6) {...}

- Another assignment statement or increment statement modifies the value in memory

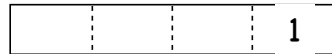
row++;

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## Multiple Variables

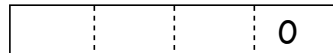
```
int row = 0;  
int i = row;  
row++;
```

1. Allocate memory for row.



2. Put 0 in the memory.

3. Allocate memory for i.



4. Copy the value from row to i.
5. Increment the value in row.

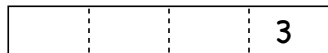
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```
public void press3 () {  
    int num = 3;  
    numberPressed(num);  
}
```

## Passing Parameters

```
public void numberPressed (int number) {...}
```

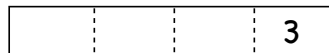
1. Allocate memory for num.



2. Put 3 in the memory.

3. Control flows to the method declaration.

4. Allocate memory for number.



5. Copy the value from num to number.

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# Object Variables

- ◉ Declare a variable that refers to an object  
`FilledRect rect;`
- ◉ Computer allocates memory for an object id
- ◉ Value is initially null

null
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# Constructing an Object

- ◉ Construct an object by calling a constructor  
`new FilledRect (10, 20, 30, 40, canvas);`
- ◉ Computer allocates enough memory to hold all the instance variables of the object
- ◉ Computer gives the object an object id


 FilledRect1

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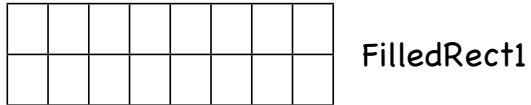
# Assigning to an Object Variable

```
FilledRect rect = new FilledRect (10, 20, 30, 40, canvas);
```

1. Allocate memory for rect.



2. Construct the FilledRect.



3. Assign the FilledRect object id to rect.