Computer Science: Create Your Own RPG Day #4

OPPTAG Explorations 2014

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Public vs Non-Public Classes

- Public: Visible to all classes in all packages. The name of the class must be the same as the name of the file.
- No Modifier: Visible only to classes in the same package. The name of the class does not have to be the same as the name of the file.

Public, Protected, and Private Variables and Methods

- Public: The variable *or method* can be seen by all classes in all packages.
- Private: The variable *or method* can only be seen by the class.
- Protected: The variable *or method* can be seen by all classes in the same package, and all *subclasses* (we will see this tomorrow).
- No Modifier: The variable *or method* can be seen by all classes in the same package, but not *subclasses* (we will see this tomorrow).

Easy Table for Memory

Modifier	Class	Package	Subclass	Other Packages
public	Y	Y	Y	Y
protected	Y	Y	Y	N
no modifier	Y	Y	N	N
private	Y	N	N	N

Scoping it Out!

```
package package1;

public class class1 {
   int a;
   public double b;

   private void mult(int k, int l){
      a = k*l;
   }
}


class class2 {
   protected String c;
   private double d;
   public static short e;

   protected void setC(String m){
      this.c = m;
   }
}
```

```
package package2;

public class class3 {
   private boolean f;
   protected byte g;
   private static long h;

   protected void sayHi(){
      System.out.println("Hello World!");
   }
}

class class4 {
   public class3 i;
   static char j;
}
```

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- *Yes*. We don't necessarily need to see graphics to play a game. We could also use ASCII characters to approximate an image. (But that's no fun.)
- In Java, most visible GUI objects are contained in the *Swing* package. Ways to interact with the GUI are kept in the *awt* package.

The Swing Package and Some Classes

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- javax.swing.JTextField: This gives us a 1D text field (line of text space).

Example #1: Lets Make a Terminal!

Create a new class. Put the following in it.

```
private static JFrame jf = new JFrame("name");
private static JPanel jp = new JPanel(
    new BorderLayout());
private static JTextField textField= new JTextField(40);
private static JTextArea textArea= new JTextArea(10,40);
```

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```

Create a main method in your class.

Example #1

Put the following in your main method. Then run your code to check if it works.

```
jf.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
textArea.setEditable(false);
jp.add(textField, BorderLayout.NORTH);
jp.add(textArea, BorderLayout.SOUTH);
jf.add(jp);
jf.pack();
jf.setVisible(true);
```

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- `setEditable(false)`: Prevents the text area from being edited.
- `new JPanel(new BorderLayout())`: Creates a layout. A *layout* is a way to organize objects in a panel.

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- `jf.pack()`: Sets the size of the frame so that it is just big enough to hold our panel.
- `jf.setVisible(<boolean>)`: Makes the frame visible (otherwise the user can't see it).

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Example #2: Lets Interface with Our Terminal!

Create a new classfor your KeyAdapter:

```
class ka extends KeyAdapter{

   private JTextField textField;
   private JTextArea textArea;

   public ka(JTextField textField, JTextArea textArea){
      this.textField = textField;
      this.textArea = textArea;
   }
}
```

Example #2

Create the following method in your KeyAdapter:

```
@Override
public void keyPressed(KeyEvent e)
   switch(e.getKeyCode())
   case KeyEvent.VK_ENTER:
      if(!textField.getText().equals(""))
         String s = textArea.getText();
         textArea.setText(s + "\n"
               + textField.getText());
         textField.setText("");

   break;
```

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- `KeyEvent.VK_ENTER`: This is the event for a key being pressed.

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- SimpleWorld: This manages all of the movements of objects, and drawing the images.
- SimpleWorldObject: This object can draw over the screen (things like pause, dialog, etc.).

What Must Be Overridden

The following must be overridden in an object that *extends* SimpleSolid

- `abstract public void collision(SimpleObject s)`: This method is called automatically when a collision happens. The argument "s" is the object the solid had a collision with.
- `abstract public void update()`: This method is called 20 times per second! Use this to update the game's state.
- `abstract public char id()`: This method is used for other objects to find out the id of an object it is colliding with.

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- `player.moveCell(x, y, 8, false)`: over 8 frames, moves the player to the cell (x, y) in the world.

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- `SimpleSolid personAbovePlayer = player.getNorthSolid()`: gets the object above the player.

Worldly Useful Methods

- `SimpleWorld world = new SimpleWorld(20, 20, 16, 16, "My first java game!")`: Creates a map of 20x20 cells, each of which are 16x16 pixels wide. Gives the application the name "My first java game!"

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- `world.setSimpleWorldObject(swo)`: adds a simple world object.
- `world.setBGImage("floor.png")`: sets the background image for the world.
- `world.start(false)`: starts the game either in fullscreen (true) or a window (false)

Sneak Peak #3

The following is in `SimpleWorld.start(false)`.
SimpleWorld extends the *JFrame* class.

```
this.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
this.setTitle(title);
this.setIgnoreRepaint(true);
this.pack();
this.setResizable(false);
this.setVisible(true);
```

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- Imperative means that our programs has statements and states (variables). If a programming language is imperative, we can change states after we've initialized them.
- The *Java Virtual Machine* is a virtual program that simulates a computer inside your computer. Instead of creating bytecode for your computer, we compile our code into bytecode for the virtual machine instead.

Some languages are similar to Java.

- C# is almost identical.

```
class Program{

public static int Fibonacci(int n){
    int a = 0;
    int b = 1;
    // A comment.
    for (int i = 0; i < n; i++){
        int temp = a;
        a = b;
        b = temp + b;
    }
    return a;
}
```

Not all languages use a VM.

- Objective-C and C++ usually compile to machine binaries.

```
import <Foundation/Foundation.h>

int main (int argc, const char* argv[])
{
    NSAutoreleasePool *pool =
          [[NSAutoreleasePool alloc] init];
    NSLog (@"Hello, World!");
    [pool drain];
    return 0;
}
```

Not all languages are object oriented.

- C and FORTRAN (pre-2003) don't have classes..

```
int main(void){
   char *str[] = { "first", "second", "third", 0 };
   char **w = str;

   while(*w){
      printf("%s\n", *w++);
   }

   return 0;
}
```

Not All Languages are Imperative

- Haskell and ML are functional languages.

```
module Main where

main :: IO ()
main = putStrLn "Hello, World!"

fibonacci :: Integer -> Integer
fibonacci 0 = 0
fibonacci 1 = 1
fibonacci n = fibonacci (n-1) + fibonacci (n-2)
```

Some Languages are Both!

- Python! A crazy (yet interesting) language.

```
#imperative
def f(x) :
    return x ** 2

#functional
g = lambda x: x**2

#We don't have to declare variables!
for i in range[1,9]:
    string = "countdracula" + str(i)
```

Not All Languages make Programs!

- Verilog and VHDL are languages used to design hardware.

```
library IEEE;
use IEEE.STD_LOGIC_1164.ALL;

entity and_gate is
    Port ( IN1 : in  STD_LOGIC;
           IN2 : in  STD_LOGIC;
           OUTPUT : out STD_LOGIC;
end and_gate;

architecture Behavioral of and_gate is
begin
    OUTPUT <= IN1 and IN2; -- 2 input AND gate
end Behavioral;
```

Scripting Languages

- HTML, Javascript, CSS, LaTeX...

```
\begin{frame}[fragile]{Scripting Languages}
\begin{itemize}
\item HTML, Javascript, CSS, \LaTeX...
\end{itemize}
\begin{semiverbatim}\code{
    ...
}\end{semiverbatim}

\end{frame}
```

Assembly

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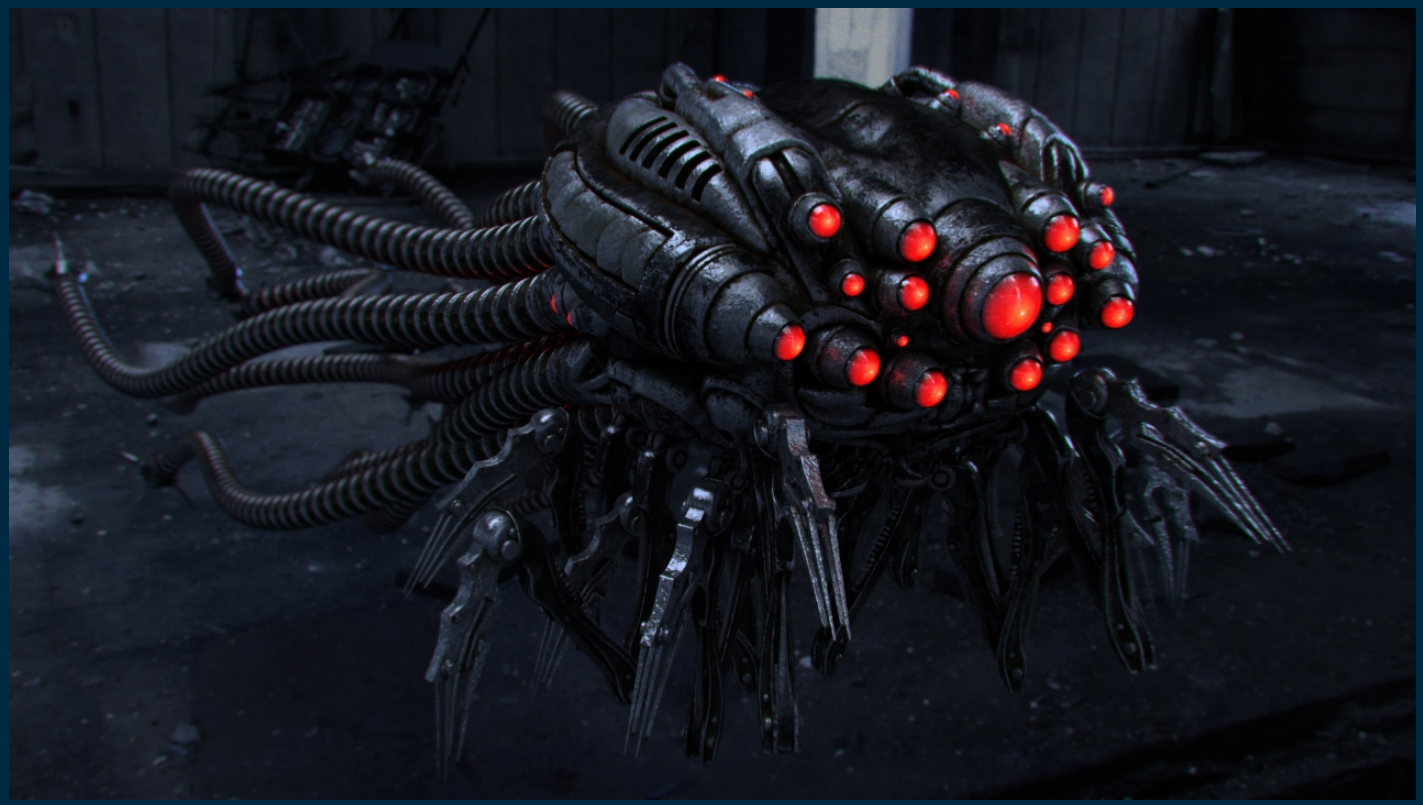

Assembly

- MIPS, ARM, AVR, x86...

Operation	$d = $s + $t;
Syntax	add $d, $s, $t
Encoding	0000 00ss ssst tttt dddd d000 0010 0000

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- What language is almost identical to Java?
- Is java the best language?
- Philosophical Question: Is there a way to *compile* the following into English:

안녕하세요 제 이름은 브라이언입니다

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- Electricity encoded as 1's and 0's are what's used by the computer.

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- Electricity encoded as 1's and 0's are what's used by the computer.
- Computers use billions of transistors which perform boolean logic.
- Boolean logic is just like the boolean operators we have learned (`&&`, `||`, `!`), except "1" is true and "0" is false.

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- Boolean logic is just like the boolean operators we have learned (`&&`, `||`, `!`), except "1" is true and "0" is false.
- Using AND, OR, and NOT computers do everything you see on a daily basis.
- This means that colors, sounds, movies, everything can be represented by bits!

1's and 0's Everywhere!

- Electricity encoded as 1's and 0's are what's used by the computer.
- Computers use billions of transistors which perform boolean logic.
- Boolean logic is just like the boolean operators we have learned (`&&`, `||`, `!`), except "1" is true and "0" is false.
- Using AND, OR, and NOT computers do everything you see on a daily basis.
- This means that colors, sounds, movies, everything can be represented by bits!

But how do we read them?

- Bits can represent integers (`int`).
- To convert a binary number to an integer we must multiply each binary number by 2 to the power of its position (2^p), and then add them together.

Binary	0	1	0	1	1	0

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$$\text{Total} = 0 + 16 + 0 + 4 + 2 + 0 = 22$$

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$$010110 \text{ base } 2 = 22 \text{ base } 10$$

A few more examples

Binary	1	0	0	1

A few more examples

Binary	1	0	0	1
Position	3	2	1	0

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$$\text{Total} = 8 + 0 + 0 + 1 = 9$$

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1001 base 2 = 9 base 10

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$$\text{Total} = 32 + 0 + 0 + 4 + 2 + 1 = 39$$

A few more examples

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Position	3	2	1	0
2^p	2^3	2^2	2^1	2^0
Multiplied	1^*8	0^*4	0^*2	1^*1

$$\text{Total} = 8 + 0 + 0 + 1 = 9$$

$$1001 \text{ base } 2 = 9 \text{ base } 10$$

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Position	5	4	3	2	1	0
2^p	2^5	2^4	2^3	2^2	2^1	2^0
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$$\text{Total} = 32 + 0 + 0 + 4 + 2 + 1 = 39$$

$$100111 \text{ base } 2 = 39 \text{ base } 10$$

Converting from Integers to Binary

To go backwards we need to find the highest power of 2 that is less than our number. This will be a '1'. We then subtract the highest power of 2 from our number, and then repeat.

13 base 10 = ?

Position	3	2	1	0

Converting from Integers to Binary

To go backwards we need to find the highest power of 2 that is less than our number. This will be a '1'. We then subtract the highest power of 2 from our number, and then repeat.

13 base 10 = ?

Position	3	2	1	0
Multiplied	1*8	?*4		

Converting from Integers to Binary

To go backwards we need to find the highest power of 2 that is less than our number. This will be a '1'. We then subtract the highest power of 2 from our number, and then repeat.

13 base 10 = ?

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13 base 10 = ?

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Multiplied	1^*8	0^*4	1^*2	$?^*1$
Binary	1	1	0	?

Converting from Integers to Binary

To go backwards we need to find the highest power of 2 that is less than our number. This will be a '1'. We then subtract the highest power of 2 from our number, and then repeat.

13 base 10 = 1011 base 2

Position	3	2	1	0
Multiplied	1^*8	0^*4	1^*2	1^*1
Binary	1	1	0	1

Quiz: One with the Machines!

- 15 base 10 =

Quiz: One with the Machines!

- 15 base 10 = 1111 base 2
- 8 base 10 =

Quiz: One with the Machines!

- 15 base 10 = 1111 base 2
- 8 base 10 = 1000 base 2
- 5 base 10 =

Quiz: One with the Machines!

- 15 base 10 = 1111 base 2
- 8 base 10 = 1000 base 2
- 5 base 10 = 101 base 2
- 42 base 10 =

Quiz: One with the Machines!

- 15 base 10 = 1111 base 2
- 8 base 10 = 1000 base 2
- 5 base 10 = 101 base 2
- 42 base 10 = 101010 base 2
- 11 base 2 =

Quiz: One with the Machines!

- 15 base 10 = 1111 base 2
- 8 base 10 = 1000 base 2
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- 42 base 10 = 101010 base 2
- 11 base 2 = 3 base 10
- 010 base 2 =

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- 010 base 2 = 2 base 10
- 1011 base 2 = 11 base 10
- 01100 base 2 = 12 base 10
- 1011011 base 10 = 91 base 10

Game Engine Activites!

Lets make a maze game together! If you have not done so already, download the game engine (resources) from my website.