

CS101

Problem Solving and Object-Oriented Programming

Introduction: Using Alice 2.0



What is Computer Science?

- A field at the intersection of Math, Engineering, Medicine, Biology, Environmental Sciences....and on and on...
- Study dynamic processes difficult or impossible to observe
 - Via computation, simulation, analysis, and visualization e.g.
 - global warming
 - protein folding
 - Protein docking
 - Economic predictions
 - etc

What does a computer do?

- A computer is a *machine* that performs simple tasks according to specific instructions.
- Computers internally just keep doing the same thing over and over:

1. Get the next instruction
2. Do whatever it says
3. Go back to step #1

(fetch, decode, execute)



- A computer does **EXACTLY** what its instructions tell it to!
- But its internal instructions are in binary -- too hard for people

Adapted from Ballesteros 09,
Lerner 08, and/or Meng 05



Programs and Languages

- Program: *a set of instructions that tell the computer what to do*
 - Following specific syntax
 - Other human beings will read the program, write it in a nice and clean way!
- Different levels of instruction
 - High level language: closer to human language, e.g. Java, C++, Visual Basic
 - Machine language: the code the computer actually reads in binary
 - Assembly language: mnemonic code that help human to read and write machine code

Natural Languages

- Computers don't understand English
- Need to deal with
 - Ambiguity
 - Redundancy
 - Literalness
- So, we express what a computer should do in a **formal language**





Different Levels of Programming Language

- Example of high level language

```
value = value + 2;
```

- Example of assembly language code

```
add $r0, 2
```

- Example of machine language code

```
000000000010000100010000000010000
```

- Compilers translate high level programs into machine code



Program Design

- We don't start with writing program code, very much the same as the civil engineers don't start with laying bricks, auto engineers don't start with putting engines and transmissions together
- We start with *design*!
- Many different ways of designing, just like any other engineering disciplines

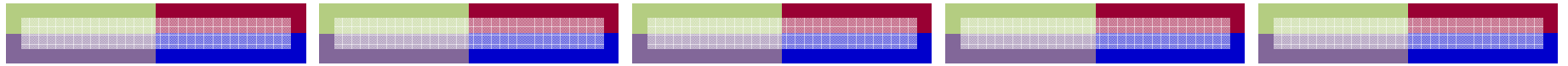


User Stories

● Contain

- Basic description of what happens when program runs
- Nouns in story (Alice, the White Rabbit) correspond to *objects*
- Verbs correspond to *actions*
- Chronological flow describes the sequence of the actions

When the program begins, Alice and the White Rabbit are facing Each other, Alice on the left and the White Rabbit on the right. Alice turns her head and then greets us. The White Rabbit also turns and then greets us. Alice and the White Rabbit introduce themselves. Simultaneously, Alice and the White Rabbit say “Welcome to our world.”



Write the flow of this story as a sequence of objects and actions

When the program begins, Alice and the White Rabbit are facing each other, Alice on the left and the White Rabbit on the right. Alice turns her head and then greets us. The White Rabbit also turns and then greets us. Alice and the White Rabbit introduce themselves. Simultaneously, Alice and the White Rabbit say “Welcome to our world.”

1. Alice turns her head toward the user
2. Alice greets the user
3. The white rabbit turns toward the user
4. The white rabbit greets the user
5. Alice introduces herself
6. The white rabbit introduces himself
7. Simultaneously, Alice and the white rabbit say “Welcome to our world.”





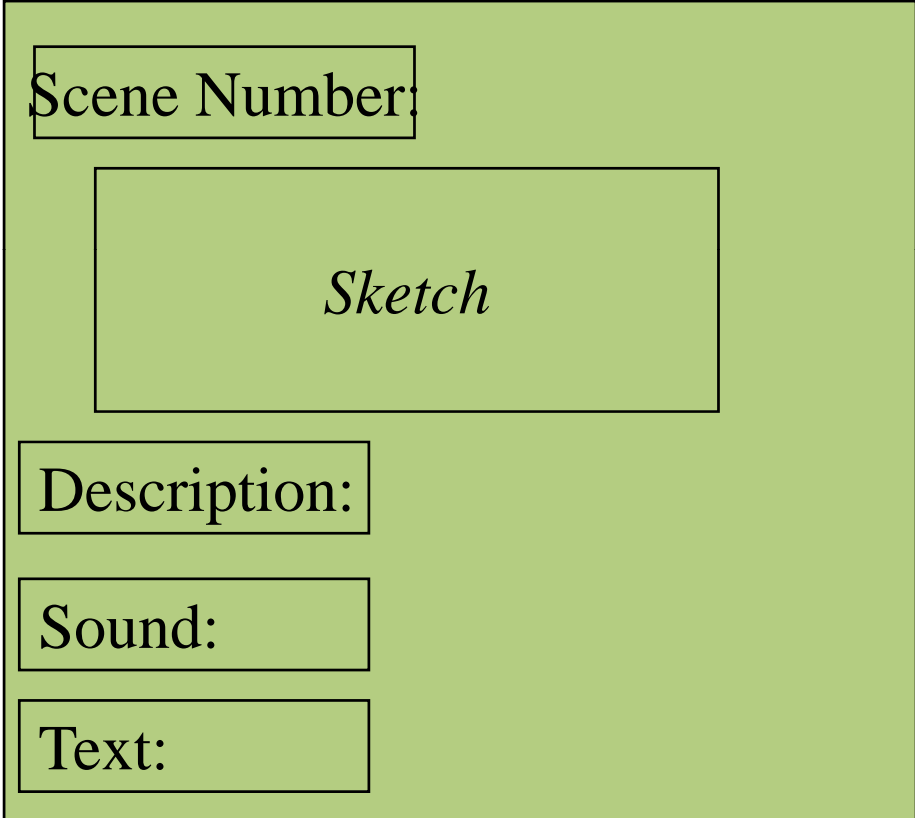
Algorithms

- A sequence of steps to solve a problem
 - The sequence of steps in the flow we wrote are an *algorithm* in computer science terms
- **Algorithm:** a list of actions to perform a task or solve a problem
 - Normally, not tied to any particular programming language syntax
- **Pseudo-code:** when the algorithm description is detailed and very close to the actual program code, this description can be called a piece of *pseudo-code*



Storyboard and Scenes

- Sketch of each shot in a film
 - Include arrows to show character or camera movement
- Together make graphical version of story



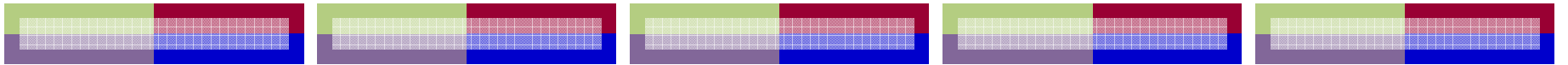
Scene Number:

Sketch

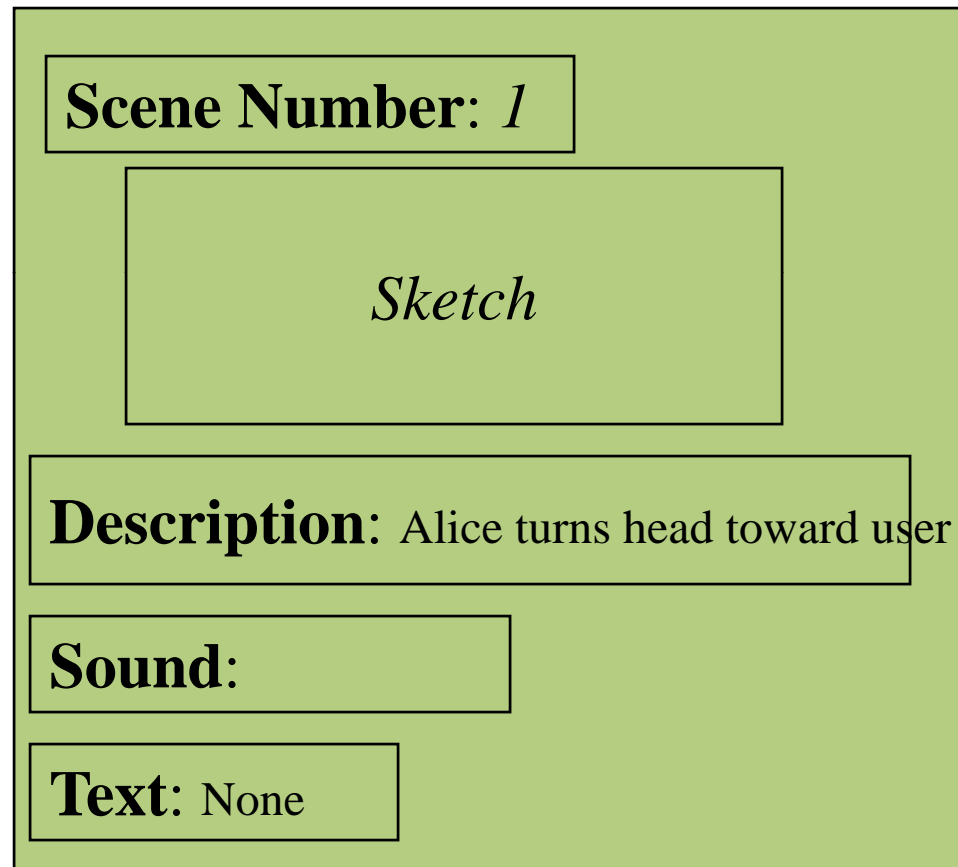
Description:

Sound:

Text:



Alice Scene



Adapted from Ballesteros 09,
Lerner 08, and/or Meng 05





Revise the Design

- It is unlikely that the first design is the final one to use
- Even if the outline of a solution is good, need to revise the steps to make it more detailed, close to final implementation
- For the Alice animation, we conclude that the actions can be described in 7 scenes