Programming as Modeling

CSE 142, Summer 2003

Computer Programming 1

http://www.cs.washington.edu/education/courses/142/03su/

Readings and References

- Reading
  - » Chapter 2, *Intro to Programming and Object-Oriented Design Using Java*, Niño and Hosch

What is Computer Science?

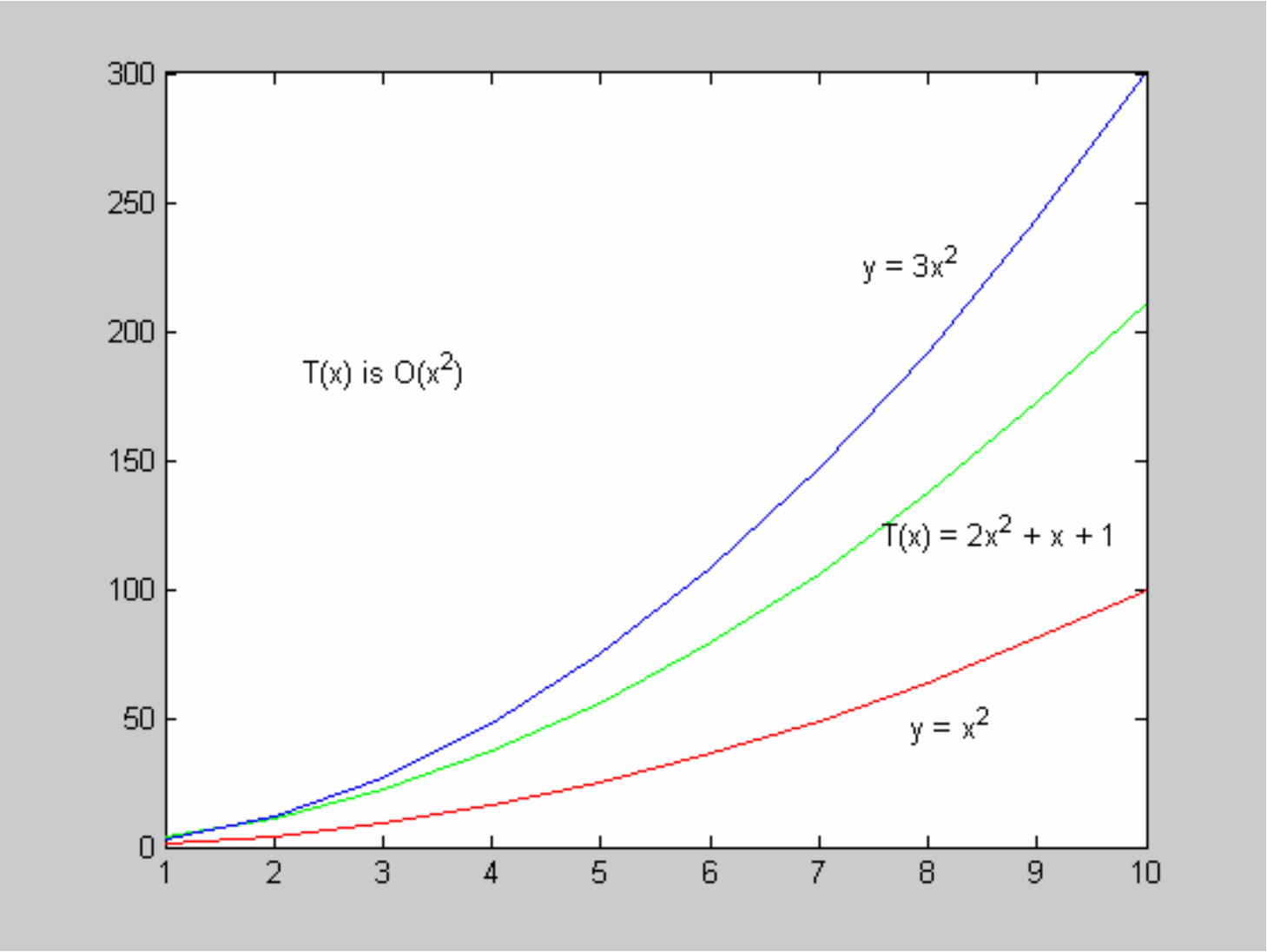
- What do you think it is?

Metaphor: Programs as Math

- We can think of programs as *executable math*
  - » a program calculates some result for us
- Consider:

$$Area = \pi \cdot Radius^2$$

- We can employ such expressions in programs.
- Most of our intuitions and knowledge about mathematics apply to computers.




```
x = 1:10;
y1 = x.*x;
y2 = 2*(x.*x)+x+1;
y3 = 3*(x.*x);
plot(x,y1,'r')
hold on
plot(x,y2,'g')
plot(x,y3,'b')
```

Using the program Matlab to calculate and plot function values

Metaphor: Programs as Directions

- Imagine giving campus directions:
  - » To another student
  - » To a tourist
  - » To a robot
- The student operates at a higher level of *abstraction* with a richer *vocabulary* of *shorthands* than the others
- An *algorithm* is a plan for how to accomplish a task
  - » A *program* is a software implementation of an algorithm
- Good algorithms (at any level of abstraction) require precision

Metaphor: Programs as Simulations

- We also can think of programming as creating or simulating both *real* and *virtual* worlds.
- We can define things in our programs that *model* the things in our world. We call these things *objects*.
- Programs are *plastic*: they are easy to mold to our wishes
  - » Can be free of the constraints of real life!
- The limit of plasticity: big programs become as hard to work with as real-world entities

What is Computer Science?

- Computation?
- Abstraction?
- Software Development?
- A useful viewpoint: think of it as modeling
  - » the model may be of something specific like a car or a weather system
  - » the model may be of something abstract like social interactions or a logical system of equations

Overview of CSE 142

- We'll learn how to model…
  - » Objects
  - » Relationships
  - » Data
  - » Computation
- While learning how to create software systems using the Java programming language

Modeling: what? why?

- What are some examples of models?

- Why do we use models of objects?

Modeling: how?

- How do we model objects?

World of Objects

- Learn to think about *properties* and *responsibilities* of objects
  - » Properties: information relevant to the object
  - » Responsibilities: tasks an object performs
- Learn to think about how objects relate to each other in a system

Student Example: Properties

- Let’s model a student object in the context of a course registration system
- Name examples of relevant properties:

Student Example: Responsibilities

- What are some responsibilities (tasks) for the student in a course registration system?

Retail Store Example

- Let’s model a system to store inventory of a retail store that sells men’s and women’s shoes
- Give some examples of objects in the system

Retail Store Components

Object	Properties	Responsibilities

Summary

- Modeling the world with objects in software is called object-oriented programming.
- Objects have properties and responsibilities
- Modeling includes developing abstractions for objects and creating relationships among objects

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