Computational Thinking

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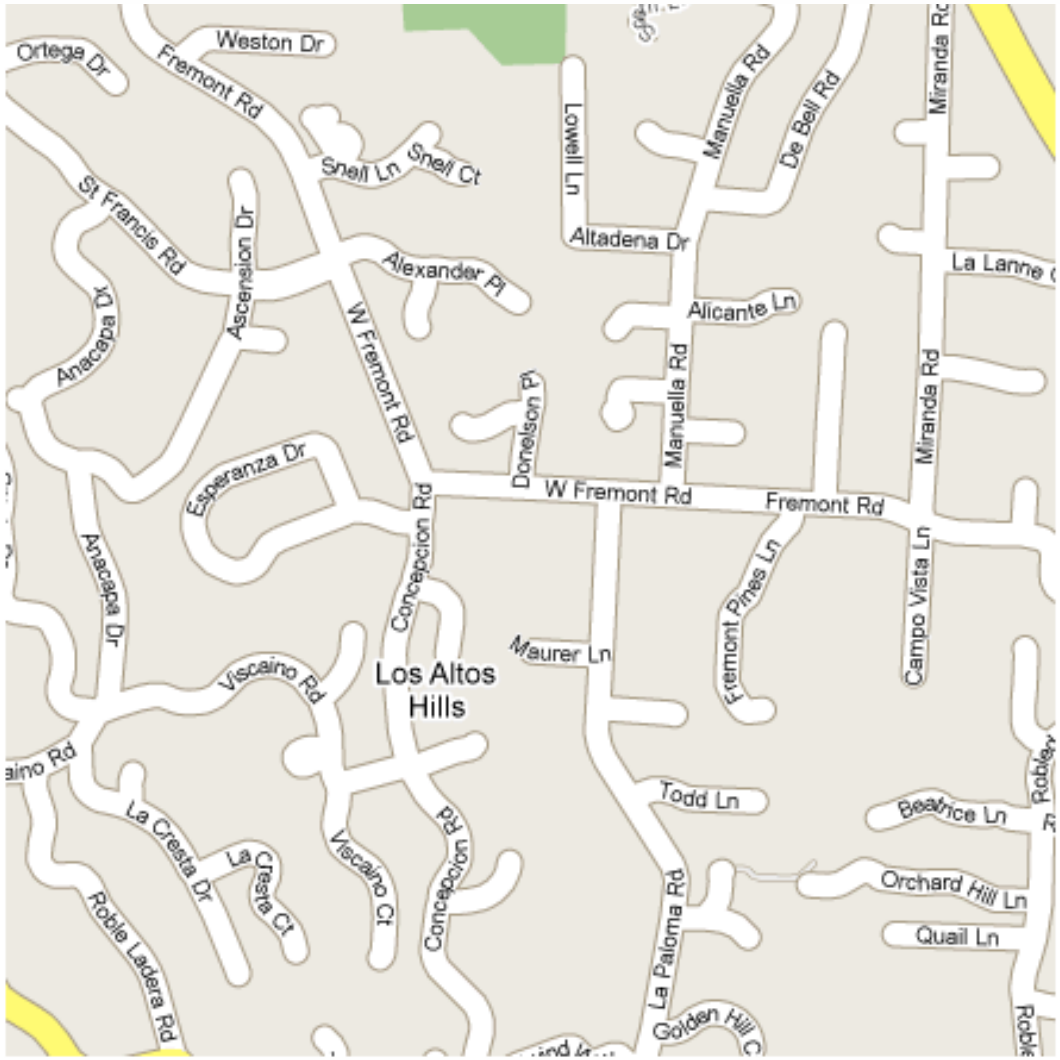
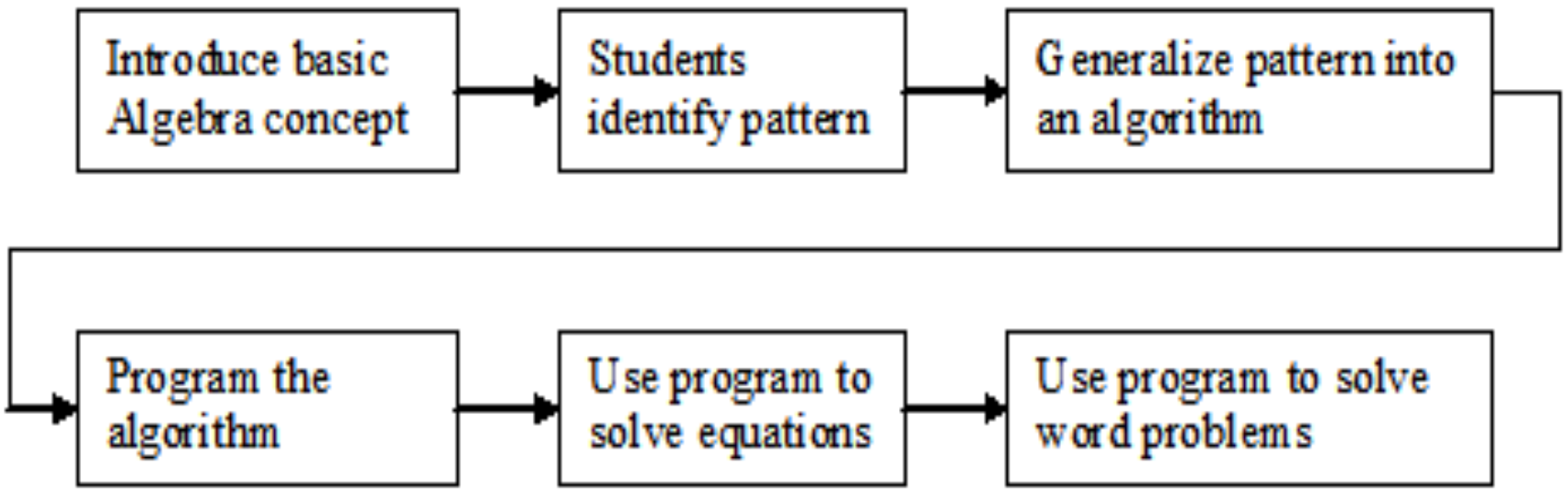
Abstraction



Patterns in behavior, process...

- Pattern Recognition
- Pattern Generalization
- Algorithm Design
- Write a program

Patterns to Teach Algebra



Patterns in Algebra

- Pattern recognition

Pattern -> Program

$x^2 + 6x + 9 = (x+3)(x+3)$

$x^2 + 8x + 16 = (x+4)(x+4)$

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Patterns in Algebra

- Pattern recognition

  Pattern -> Program

  $x^2 + 6x + 9 = (x+3)(x+3)$

  $x^2 + 8x + 16 = (x+4)(x+4)$

- Pattern generalization

  $x^2 + (3+3)x + 3*3$

  $x^2 + (4+4)x + 4*4$

  $x^2 + (2k)\,x + k^2$

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Patterns in Algebra

- Algorithm to recognize the pattern
  - $x^2 + bx + c$ $x^2 + 8x + 16$
  - what are b and c? 8 16

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Patterns in Algebra

- Algorithm to recognize the pattern
  - $x^2 + bx + c$ $x^2 + 8x + 16$
  - what are b and c? 8 16
  - 2 * 4 = 8
  - 4 * 4 = 16

Patterns in Algebra

- Algorithm to recognize the pattern
  - $x^2 + bx + c$ $x^2 + 8x + 16$
  - what are b and c? 8 16
  - 2 * 4 = 8
  - 4 * 4 = 16
  - does b / 2 = sqrt(c)?
  - yes: the factors are (x + b/2)(x + b/2)

Patterns in Algebra

- **Program it !**

```
b = input("what is b? ")
c = input("what is c? ")
```

Patterns in Algebra

- **Program it !**

```
b = input("what is b? ")
c = input("what is c? ")

if b / 2 == sqrt(c):
    print "factors are: ", "(x + ", b / 2,")squared"
```

Patterns in Algebra

- **Program it !**

```
b = input("what is b? ")
c = input("what is c? ")

if b / 2 == sqrt(c):
    print "factors are: ", "(x + ", b / 2,")squared”
else:
    print "this equation does not fit the perfect
square pattern"
```

More Examples

Exploring Computational Thinking

http://www.google.com/edu/computational-thinking/lessons.html

Percent Change

Program -> Pattern

pow(x, y) = x^y

Do the following:

```
>>> pow(2, 0)
>>> pow(894, 0)
```

Program -> Pattern

pow(x, y) = x^y

Do the following:

```
>>> pow(2, 0)
>>> pow(894, 0)
```

What's the pattern? Can you represent it?

```
pow(x, 0) = 1
```

Program -> Pattern

Do the following:

```
>>> pow(1, 0)
>>> pow(1, 5)
>>> pow(1, 894)
```

Program -> Pattern

Do the following:

```
>>> pow(1, 0)
>>> pow(1, 5)
>>> pow(1, 894)
```

What's the pattern? Can you represent it?

```
pow(1, y) = 1
```

Program -> Pattern

Do the following:

```
>>> pow(2, -1) == 0.5
>>> pow(3, -1) == 0.333
>>> pow(4, -1) == 0.25
>>> pow(5, -1) == 0.2
```

Program -> Pattern

Do the following:

```
>>> pow(2, -1) == 0.5
>>> pow(3, -1) == 0.333
>>> pow(4, -1) == 0.25
>>> pow(5, -1) == 0.2
```

What's the pattern? Can you represent it?

```
pow(x, -1) = 1/x
```

Math, Science and more…

Combinations with Repeats

Factorials with Names

Modeling in Biology

Present Participle

Questions?