Design

Announcements

Abstraction

```
def square(x):                    def sum_squares(x, y):
    return mul(x, x)                  return square(x) + square(y)
```

What does sum_squares need to know about square?

- Square takes one argument.   **Yes**

- Square has the intrinsic name square.   **No**

- Square computes the square of a number.   **Yes**

- Square computes the square by calling mul.   **No**

```
def square(x):                    def square(x):
    return pow(x, 2)                  return mul(x, x-1) + x
```

> If the name "square" were bound to a built-in function,
> sum_squares would still work identically.

Choosing Names

Names typically don't matter for correctness

but

they matter a lot for composition

From:	To:
true_false	rolled_a_one
d	dice
helper	take_turn
my_int	num_rolls
l, I, O	k, i, m

Names should convey the meaning or purpose of the values to which they are bound.

The type of value bound to the name is best documented in a function's docstring.

Function names typically convey their effect (**print**), their behavior (**triple**), or the value returned (**abs**).

Which Values Deserve a Name

Reasons to add a new name

Repeated compound expressions:

```
if sqrt(square(a) + square(b)) > 1:
    x = x + sqrt(square(a) + square(b))
```

```
hypotenuse = sqrt(square(a) + square(b))
if hypotenuse > 1:
    x = x + hypotenuse
```

PRACTICAL GUIDELINES

Meaningful parts of complex expressions:

```
x1 = (-b + sqrt(square(b) - 4 * a * c)) / (2 * a)
```

```
discriminant = square(b) - 4 * a * c
x1 = (-b + sqrt(discriminant)) / (2 * a)
```

More Naming Tips

- Names can be long if they help document your code:

  ```
  average_age = average(age, students)
  ```

  is preferable to

  ```
  # Compute average age of students
  aa = avg(a, st)
  ```

- Names can be short if they represent generic quantities: counts, arbitrary functions, arguments to mathematical operations, etc.
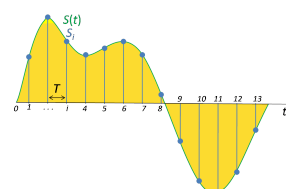
  ```
  n, k, i - Usually integers
  x, y, z - Usually real numbers
  f, g, h - Usually functions
  ```
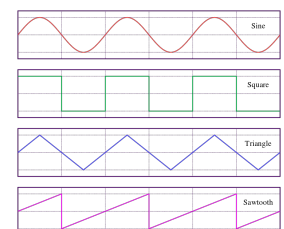
Function Example: Sounds

WAV Files

The Waveform Audio File Format encodes a sampled sound wave

A triangle wave is the simple wave form with the most pleasing sound

Sine

Square

Triangle

Sawtooth

(Demo)