

Design

Announcements

Abstraction

Functional Abstractions

```
def square(x):  
    return mul(x, x)
```

```
def sum_squares(x, y):  
    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):  
    return pow(x, 2)
```

```
def square(x):  
    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:

true_false

d

helper

my_int

l, I, 0

To:

rolled_a_one

dice

take_turn

num_rolls

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

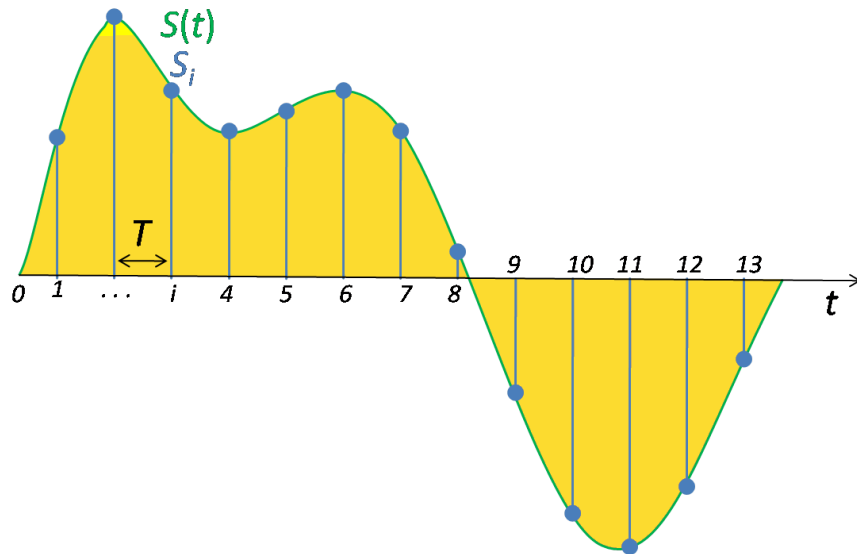
x, y, z – Usually real numbers

f, g, h – Usually functions

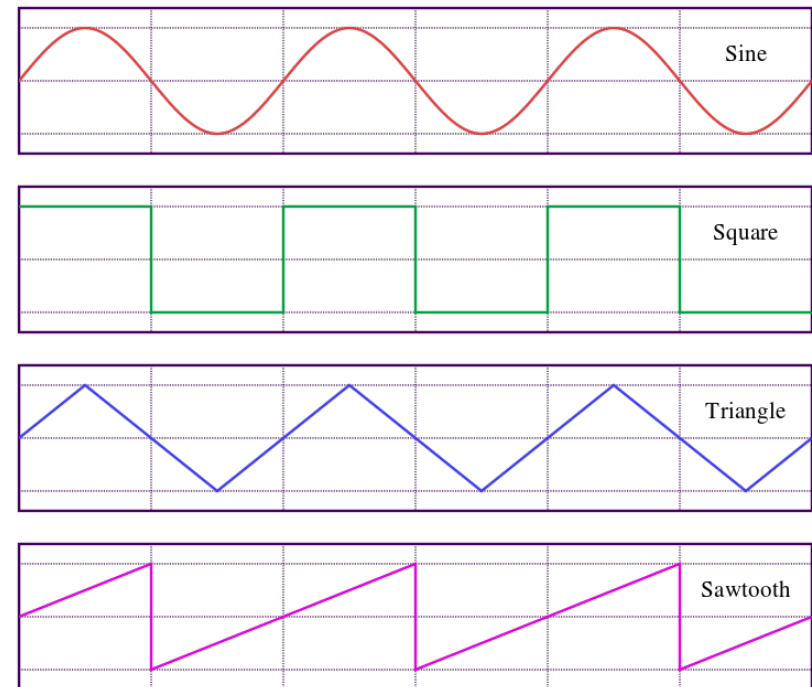
Function Example: Sounds

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



(Demo)