

Design

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## Announcements

Abstraction

## Functional Abstractions

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```
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

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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, 0	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

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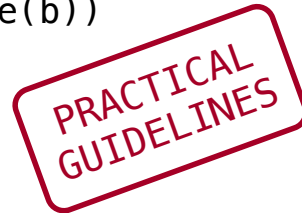
### Reasons to add a new name

*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
```



*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

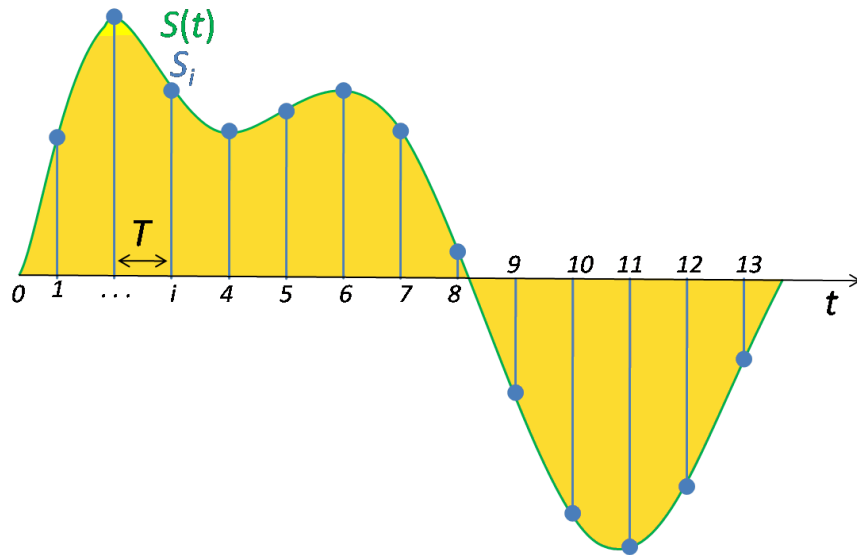
x, y, z - Usually real numbers

f, g, h - Usually functions

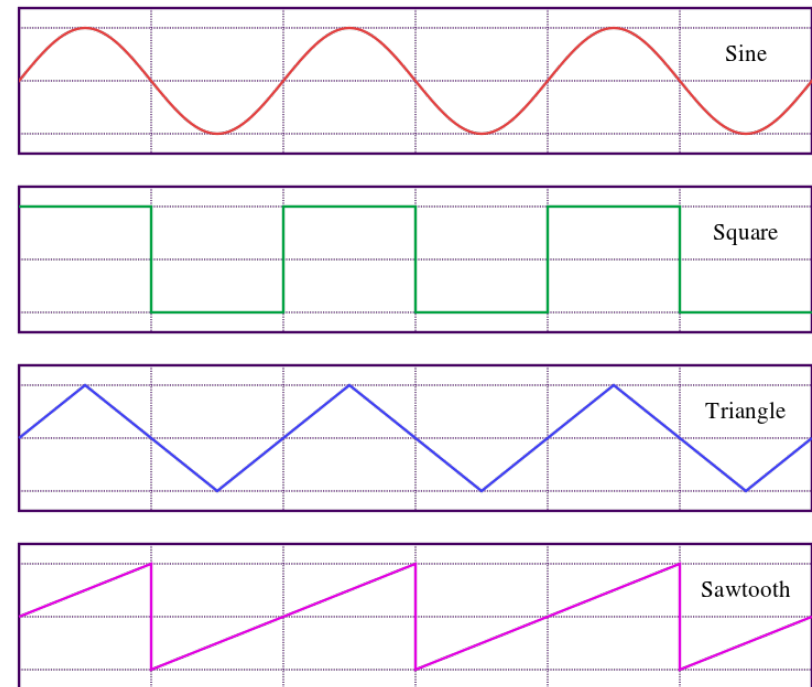
## Function Example: Sounds

## 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)