Introduction to Programming

Conditions, Recursion and Return Values - Exercises

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Based on Think Python 2nd Edition by Allen B. Downey

Exercises

- Write a compare function that takes two values, x and y, and returns 1 if $x > y$, 0 if $x == y$, and -1 if $x < y$.
- Write a function is_between(x, y, z) that returns True if $x \leq y \leq z$ or False otherwise.
- Write a function that takes two points given by their coordinates x0, x1 and y0, y1 as arguments, and returns the euclidean distance between them.

Exercises

- Write a recursive function `factorial(n)` that takes n as an argument, and returns the factorial n!. Note that $0! = 1$ (base case) and $n! = n \cdot (n - 1)!$.

- Look at your factorial function for some n (e.g. $n = 2$) using a debugger and/or `http://pythontutor.com/`. Explain what's going on. Particularly note the local frames and variable assignments.

- What happens if you call `factorial(1.5)`?

- Use `isinstance` to ensure the argument is an integer. Print some message otherwise, indicating that the caller should provide an integer as argument.

- Write a recursive function fibonacci(n) for computing the fibonacci number for n. See `https://en.wikipedia.org/wiki/Fibonacci_number`

Generative Processes

- Can you combine random numbers, conditions, recursion and turtle's methods to create generative art? See next slide for some ideas.

- https://docs.python.org/3/library/turtle.html

```
t = turtle.Turtle()
t.penup()
t.pendown()
t.pensize(size)
t.pencolor(r, g, b)
t.fillcolor(r, g, b)
t.begin_fill()
t.end_fill()
```

Generative Processes

- Draw multiple squares with various/random position, rotation and color
- Draw noisy shapes by randomizing side length and/or angle
- Randomly draw different shapes, e.g. triangles, squares or circles
- Try to keep turtle inside the window if it wants to leave it. Hint: use turtle.position() to get turtle's position, and turtle.screensize() to get the window size. Note that the origin (i.e. position (0, 0)) of turtle's coordinate system is in the center of the window.

Exercises

- For more exercises, see https:
//greenteapress.com/thinkpython2/html/thinkpython2007.html#sec80