

Building Up Solutions

Outline

From Inputs to Outputs

Quiz

Today's Lecture

- ▶ Catching up from last time (maybe)
- ▶ Three programming challenges
 - ▶ No computer? No problem!
 - ▶ You can be the computer today

Challenge 1

Write an interactive number-guessing game program.

This program should ask the user for the least and greatest possible value to guess.

The program should ask the user for one guess after another until the user has guessed the number, or they have exceeded a set number of allowed guesses.

Hint: You can pick a random number using the `randint` function:

```
from random import randint
# a random number >= 2 and < 10
randint(2, 10)
```

Evaluation

Pair up and swap programs; see what differences you spot in your implementations and argue for the correctness of your code, ask questions, etc.

Challenge 2

You may have learned a mathematical formula for computing the area of a square or circle. We have nice ways to describe those kinds of shapes—a side length, say, or a radius.

We can describe a circle as a *test*: a circle centered on the origin contains those points (x, y) such that $x^2 + y^2 \leq r$.

For a rectangle of dimensions $w \times h$ centered on the origin, we have the points (x, y) such that $|x| < \frac{w}{2}$ and likewise a second test for y and h .

Let's imagine that any shape can be defined as a *test* like this (the circle is one test; the rectangle is two tests; etc), by checking the Boolean outputs of one or more functions.

Challenge 2, Cont'd

We can compute the area of such a shape by putting it in a large enough box to hold it and throwing random “darts” at various (x, y) positions and checking to see if they pass or fail the test. If we take the ratio of darts that hit the shape and multiply by the area of the large box, we can compute the shape’s area.

For example, if $\frac{2}{3}$ of the darts pass the test in a box of side length 5, the shape must take up $\frac{2}{3}$ of the box; so its area must be $\frac{2}{3} \times 25$.

Define the Python functions `get_circle_area(r, box_size, dart_count)` and `get_rect_area(w, h, box_size, dart_count)` to approximate the area of a circle and rectangle, where `r`, `w`, and `h` are no bigger than `box_size`.

Challenge 2

Define the Python functions `get_circle_area(r, box_size, dart_count)` and `get_rect_area(w, h, box_size, dart_count)` to approximate the area of a circle and rectangle, where `r`, `w`, and `h` are no bigger than `box_size`.

Circle test: $x^2 + y^2 \leq r^2$.

Rect tests: $|x| \leq \frac{w}{2}$ and also $|y| \leq \frac{h}{2}$.

Take the ratio of successful darts and multiply by the area of the box.

Evaluation

Pair up and swap programs; see what differences you spot in your implementations and argue for the correctness of your code, ask questions, etc.

Challenge 3

Make the program from Challenge 2 interactive by asking for a shape type and appropriate parameters, computing the area, and asking for the next shape until the user types quit.

Evaluation

Pair up and swap programs; see what differences you spot in your implementations and argue for the correctness of your code, ask questions, etc.

Quiz