pythontutor.com: A platform for building programming education tools
What every learner needs to do …

Mental model of code execution
```python
x = ['a', 'b', 'c']
y = x
z = [y, 'd', 'e']
y = z
print x
print y
print z
```
C and C++ coming soon

```python
x = ['a', 'b', 'c']
y = ['d', 'e']
z = ['f', 'g', 'h', 'i', 'j', 'k', 'l', 'm', 'n', 'o', 'p', 'q', 'r', 's', 't', 'u', 'v', 'w', 'x', 'y', 'z']
y = z
print x
print y
print z
```
Python 2.7

1  x = ['a', 'b', 'c']
2  y = x
3  z = [y, 'd', 'e']
4  y = z
5  print x
6  print y
7  print z

Edit code

Step 1 of 7  Forward  Last

Line that has just executed
Next line to execute

Generate permanent link

Click the button above to create a permanent link to your visualization. To report a bug, paste the link along with a brief error description in an email addressed to philip@pgbovine.net

Generate embed code

To embed this visualization in your webpage, click the 'Generate embed code' button above and paste the resulting HTML code into your webpage. Adjust the height and width parameters as needed.
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Frames

Global frame

Objects

list

0  "a"
1  "b"
2  "c"

list

0  "d"
1  "e"
x = ['a', 'b', 'c']
y = x
z = [y, 'd', 'e']
y = z
print x
print y
print z
Python 2.7

1  x = ['a', 'b', 'c']
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Frames
Global frame
  x
  y
  z

Objects
list
  0: "a"
  1: "b"
  2: "c"
list
  0: "d"
  1: "e"
Python 2.7

```
1  x = ['a', 'b', 'c']
2  y = x
3  z = [y, 'd', 'e']
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6  print y
7  print z
```

Program output:

```
[['a', 'b', 'c']
[['a', 'b', 'c'], 'd', 'e']
```
Python 2.7

```python
x = ['a', 'b', 'c']
y = x
z = [y, 'd', 'e']
y = z
print x
print y
print z
```

Program output:

```
['a', 'b', 'c']
[['a', 'b', 'c'], 'd', 'e']
[['a', 'b', 'c'], 'd', 'e']
```
```python
x = ['a', 'b', 'c']
y = x
z = [y, 'd', 'e']
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Program output:
```
['a', 'b', 'c']
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Python 2.7

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Frames

Global frame
- x
- y
- z

Objects

list

0  "a"
1  "b"
2  "c"

list

0  "d"
1  "e"

Program output:

[['a', 'b', 'c']]

- line that has just executed
- next line to execute
1.5 million users from 180+ countries

Not just K-12 and college!!!
43% are 25-54 yrs old, 16% are 55 or older
pythontutor.com: 
A platform for building programming education tools
Let’s collaborate! How?

- **Embed** this tool within learning resources such as MOOCs, forums, and digital textbooks

- **Analyze data,** train models, and test hypotheses about novice programmer activities, bugs, and misconceptions: 13 million code submissions

- **Deploy** learning experiments at scale on a high-traffic site with heterogeneous learner population: ~5,000 learners per day, 180+ countries, all ages, {K-12, college, MOOCs, self-directed learners}