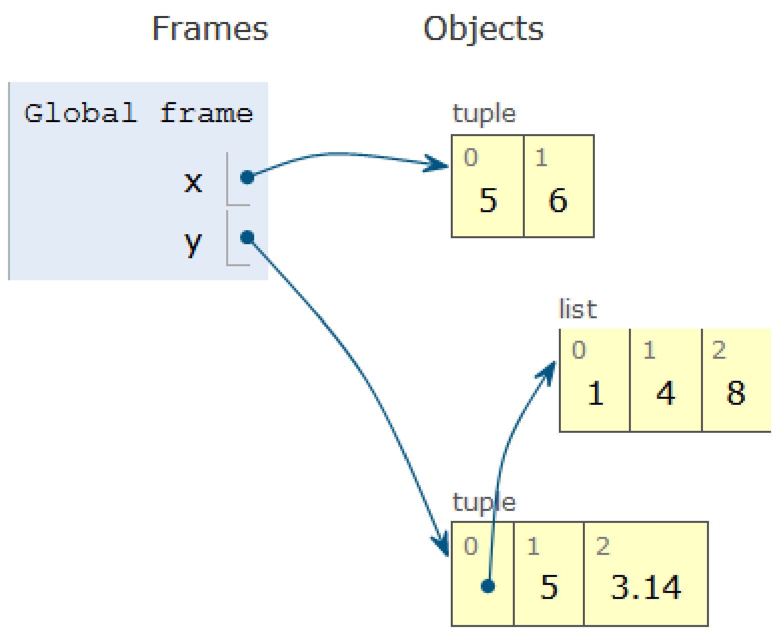
# Compsci 101
# DeMorgan's Law, Short circuiting, Global, Tuples



Susan Rodger

February 23, 2023

# `L` is for …

- **Loops**
  - While, For, Nested – Iteration!
- **Library**
  - Where we find APIs and Implementations
- **Logic**
  - Boolean expressions in if statements, loops
- **Linux**
  - The OS that runs the world?

## Keith Kirkland

- **BS ME, BFA Accessories Design, MID Industrial and Product Design**
- **Co-founder of WearWorks**
- **Wayband – wearable haptic navigation device for blind**
- **Device guided blind marathon runner in NYC marathon**

“We design products that shift people’s lives in a meaningful way”

“We take large challenges and turn them into opportunities that will one day help people and awaken the problems that can be solved. We believe in setting new standards for what is possible. ”

## Announcements

- **APT-3 due tonight**
- **Assign 3 due Thursday, March 2**
    - Sakai Assign 3 quiz due Tues. Feb 28 (no grace day!)
- **Lab 6 on Friday, do prelab**
- **Midterm grades coming – rough estimate!**

- **APT Quiz 1 – Feb 23 (today 1pm) – Mon, Feb 27**

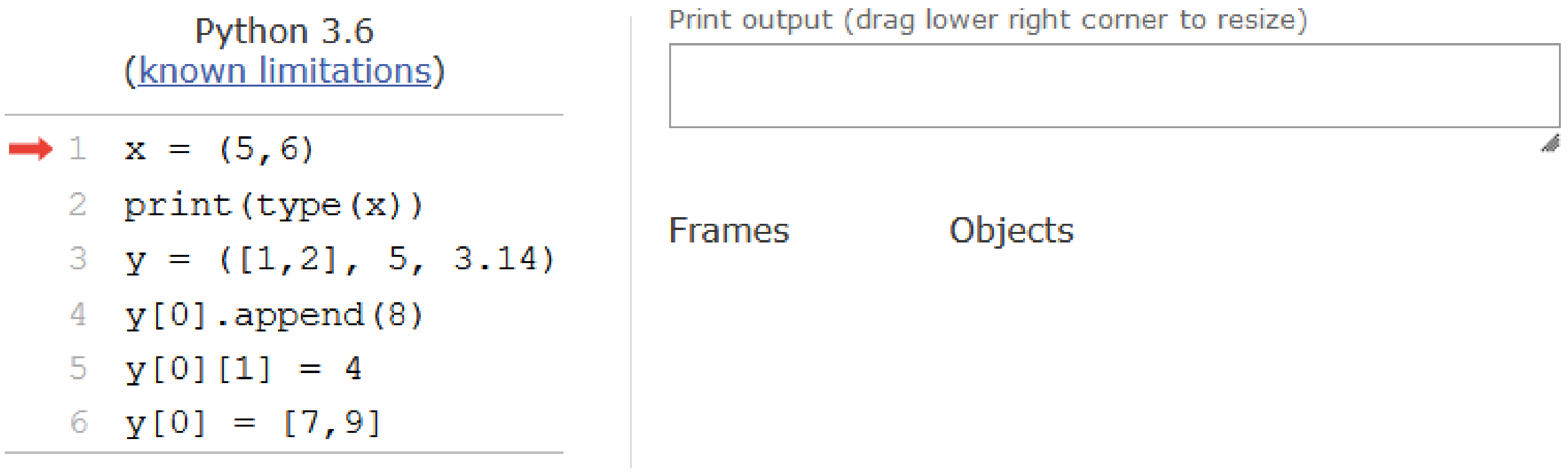
# PFTD

- **Tuples**
- **Global**
- **DeMorgan’s Law**
- **Short Circuiting**
- **APT Quiz**

# Tuple: What and Why?

- **Similar to a list in indexing starting at 0**
  - Can store any type of element
  - Can iterate over
- **Immutable - Cannot mutate/change its value(s)**
  - Efficient because it can't be altered
- **Examples:**
  - **`x = (5,6)`**
  - **`y = ([1,2],3.14)`**

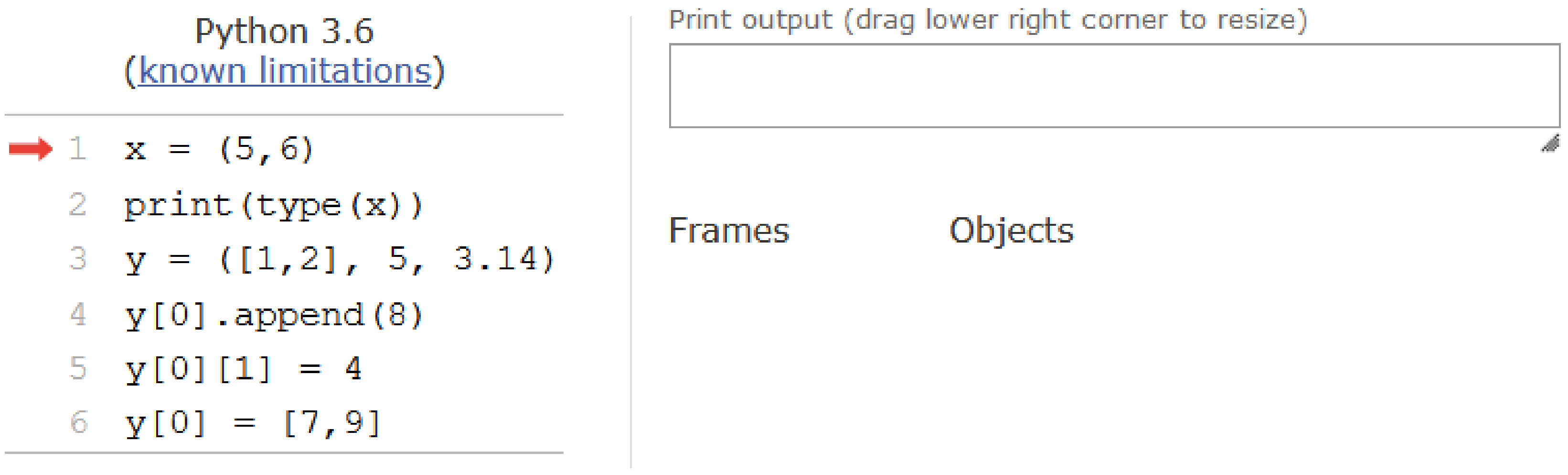
# Tuple Trace in Python Tutor



Python 3.6
(known limitations)

```
x = (5,6)
print(type(x))
y = ([1,2], 5, 3.14)
y[0].append(8)
y[0][1] = 4
y[0] = [7,9]
```

# Tuple Trace in Python Tutor



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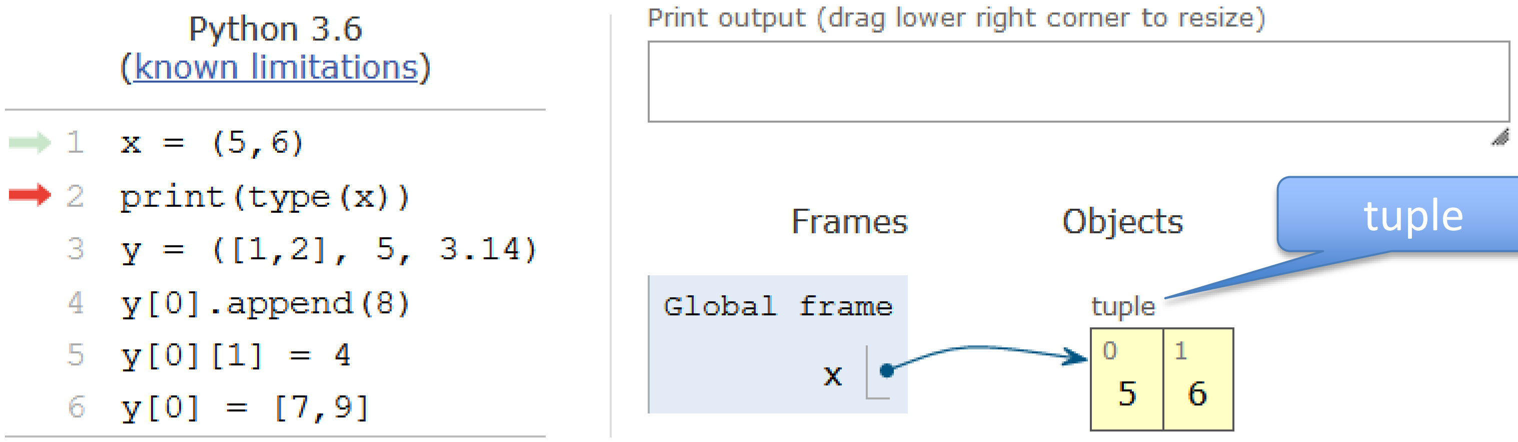

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```

tuple

# Variables and their Scope

- **Local variable – variable in function only known in that function**

- **Parameter – way to pass information to a function**

- **Global variable - variable known throughout the whole file**

## What is a global variable?

- **Accessible everywhere in the file (or "module")**
- **Variable is in the global frame**
  - First frame in Python Tutor
- **If declared global in a function:**
  - The variable in the global frame can also be reassigned in that function
  - Despite Python being in a different frame!
- **Eliminates the need to pass this value to all the functions that need it**

# When to use Global Variables

- **Typically, don't use global variables**
  - Harder to share a function if it refers to a global variable
  - Act differently than other variables

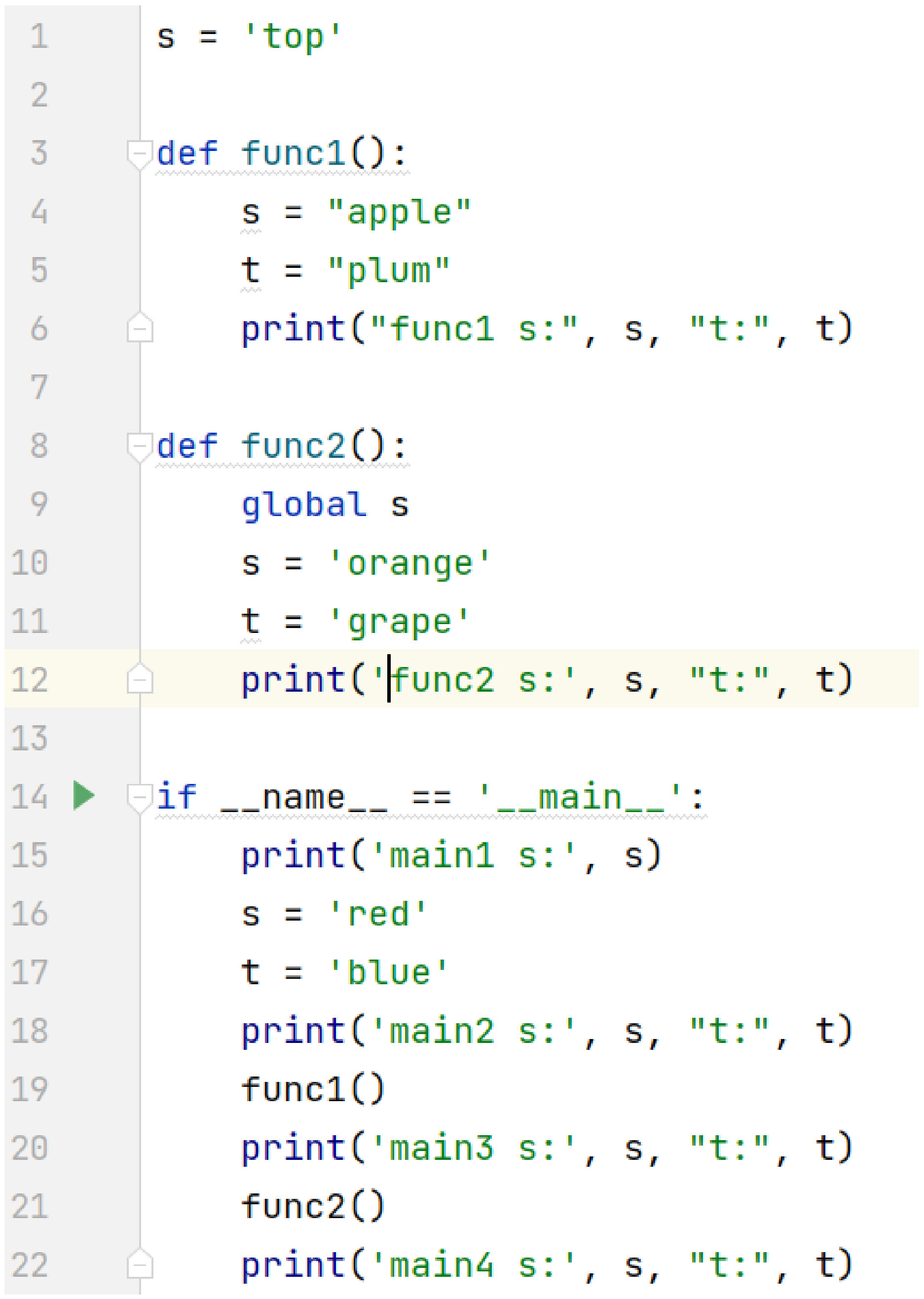
- **Sometimes makes sense**
  - Global variable is used in most functions
  - Saves passing it to every function

- **Best practice = help other humans read the code**
  - Global variables define at top of file
  - When global used in function, declared as global at beginning of function

# When reading code with globals

- **When checking the value of a variable, ask:**
  - Is this variable local to the function or in the global frame?
- **When in a function and assigning a value to a variable, ask:**
  - Has this variable been declared global?
    - If yes, reassign the variable in the **global frame**
    - If no, create/reassign the variable in the **function's local frame**

# What will print?

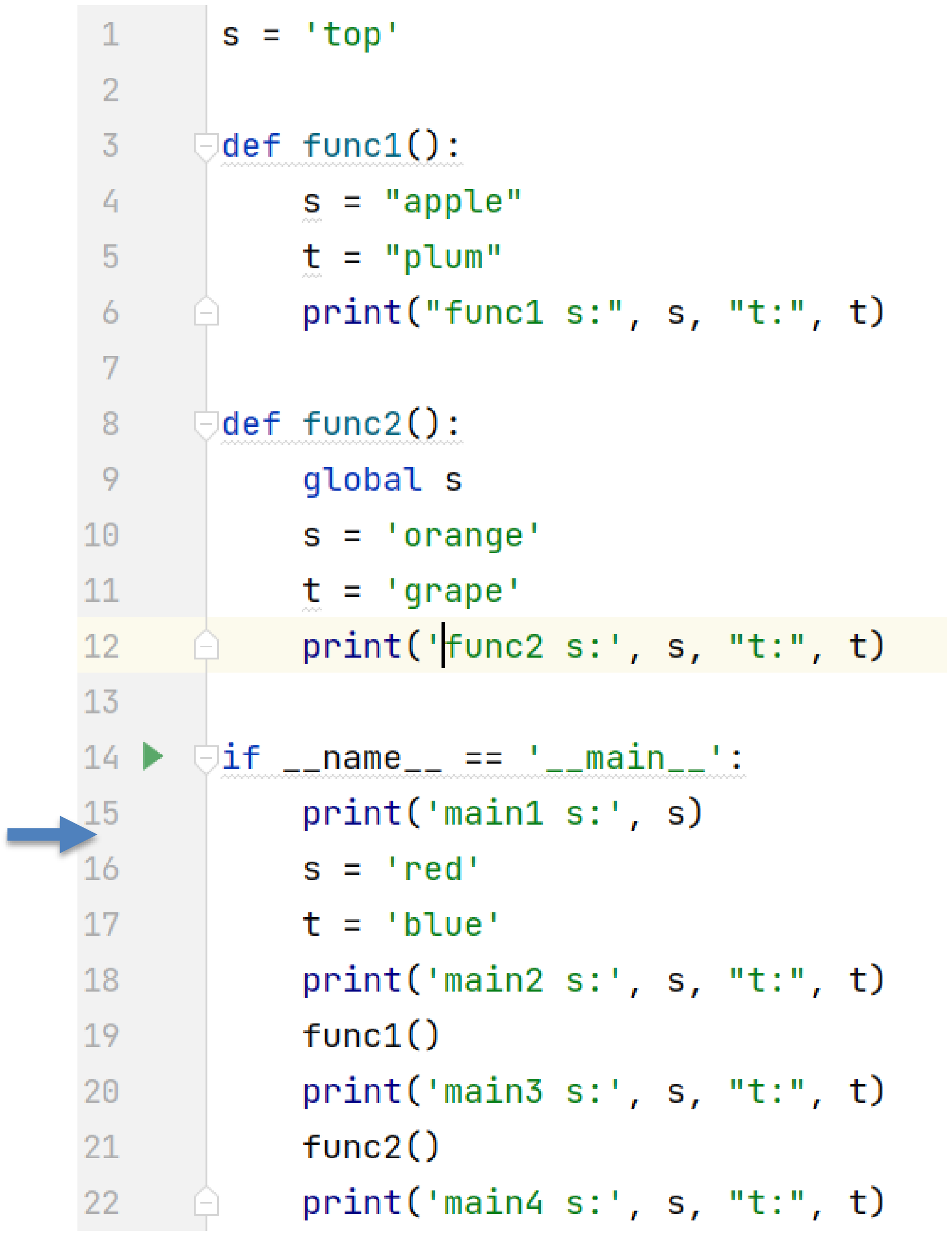


```python
s = 'top'

def func1():
    s = "apple"
    t = "plum"
    print("func1 s:", s, "t:", t)

def func2():
    global s
    s = 'orange'
    t = 'grape'
    print('func2 s:', s, "t:", t)

if __name__ == '__main__':
    print('main1 s:', s)
    s = 'red'
    t = 'blue'
    print('main2 s:', s, "t:", t)
    func1()
    print('main3 s:', s, "t:", t)
    func2()
    print('main4 s:', s, "t:", t)
```



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    func1()
    print('main3 s:', s, "t:", t)
    func2()
    print('main4 s:', s, "t:", t)
```

## What will print?

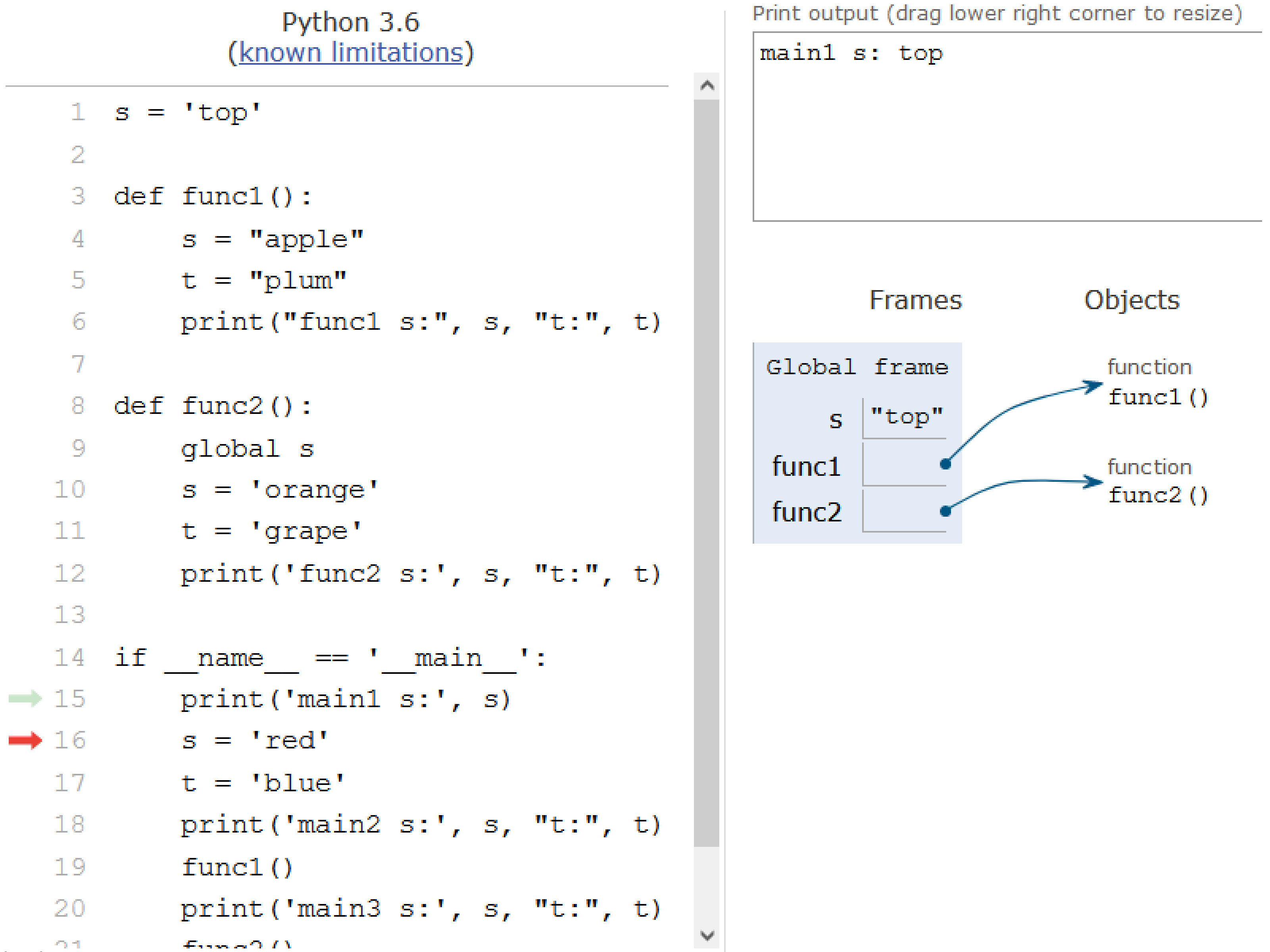
Output:

main1 s: top

## Now let’s see the same thing in Python Tutor

- **Global variables are in the global frame**

# Python Tutor – Step 6



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    print('main3 s:', s, "t:", t)
```

Print output (drag lower right corner to resize)

```
main1 s: top
```

# Variables
# What, where, read, write? (in 101)

| What is it? | Where first created? | Where accessible? (read) | Where reassign-able? (write) |
|---|---|---|---|
| Regular variable in main | In main | In main only (technically anywhere, but don't do that) | In main only |
| Regular local function variable | In function | In function only | In function only |
| Global variable | Top of file | If not reassigning the value, in main and all functions | In main or in any function that first declares it global |

# Assignment 3 Transform

- **Uses several global variables.**
- **Only use global variables when we specify in an assignment**

# WOTO-1 – Tuples and Globals http://bit.ly/101s23-0223-1

## List .index vs String .find

```
str = "computer“                   Values:
pos = str.find("m")
pos = str.find("b")

lst = ["a", "b", "c", "a"]
indx = lst.index("b")
indx = lst.index("B")
```

## Let's Write list Index function

- **Call in findIndex(lst, elm)**
- **Write it so it works like the string find function**
  - **lst** is a list
  - **elm** is an element
  - Return the position of **elm** in **lst**
  - Return **-1** if **elm** not in **lst**
  - Use while loop to implement
- **What is the while loop's Boolean condition?**

```
index = 0
while BOOL_CONDITION:
   index += 1
```

# While Boolean condition

```
index = 0
while BOOL_CONDITION:
   index += 1
```

- **What is the while loop’s stopping condition?**

## DeMorgan’s Law

- **While loop stopping conditions, stop with either:**

- **While loop needs negation: DeMorgan's Laws**

  **`not (A and B)`** equivalent to **`(not A) or (not B)`**

  **`not (A or B)`** equivalent to **`(not A) and (not B)`**

## Think: DeMorgan's Law

Fill in the blanks

| A | B | not (A and B) | (not A) or (not B) |
|---|---|---|---|
| True | True | | False |
| True | False | True | |
| False | True | | True |
| False | False | True | |

| A | B | not (A or B) | (not A) and (not B) |
|---|---|---|---|
| True | True | False | |
| True | False | | False |
| False | True | False | |
| False | False | | True |

## WOTO-2: Will this work?

## http://bit.ly/101s23-0223-2

## Short Circuit Evaluation

- **Short circuit evaluation, these are not the same!**

- **As soon as truthiness of expression known**
  - Stop evaluating
  - In `(A and B)`, if A is false, do not evaluate B

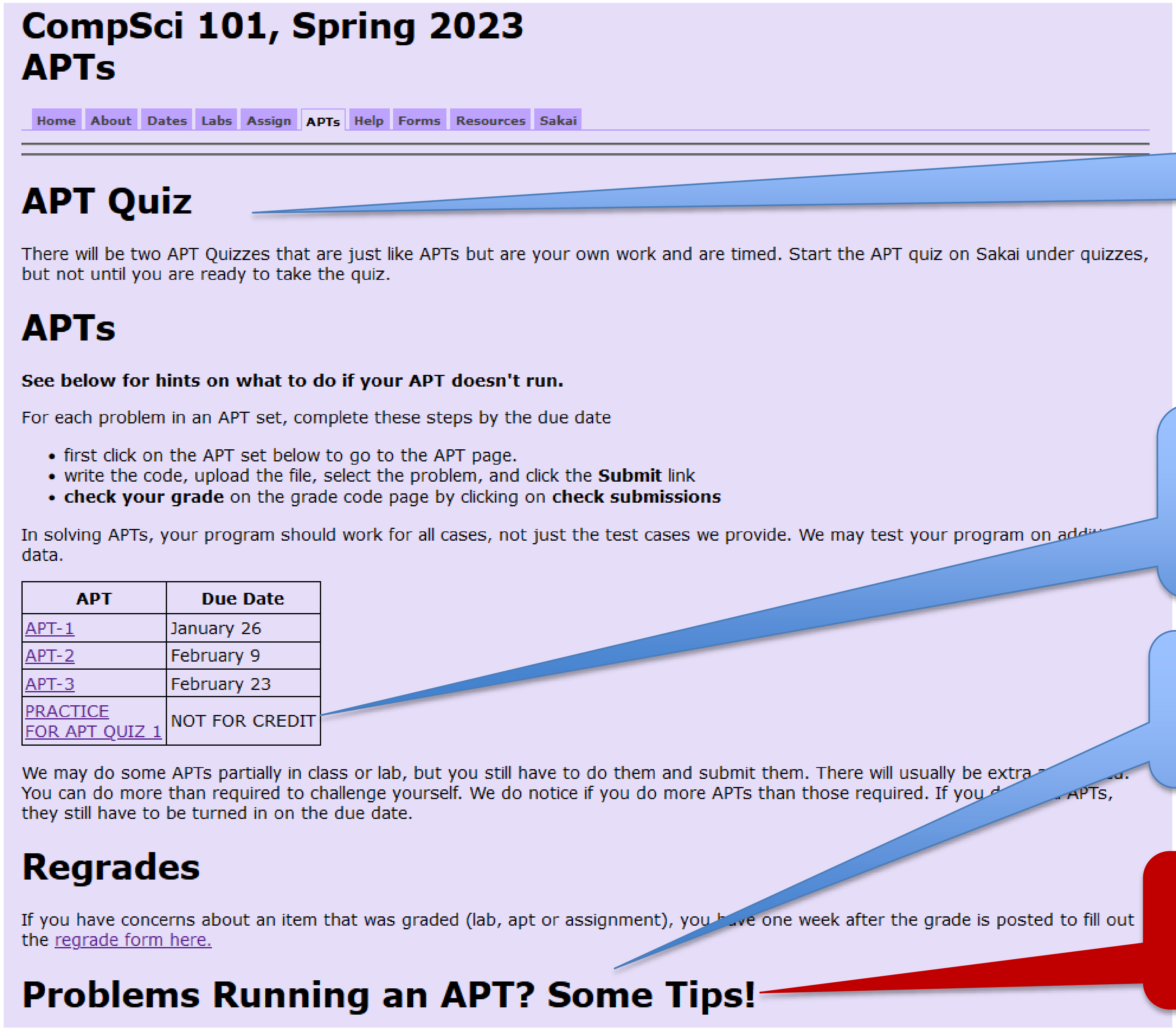
## Python Logic Summarized

- **A and B is True only when A is True and B is True**
  - If A is True
  - If A is False
- **A or B is True if one of A and B are True**
  - if A is True
  - If A is False

- **Short-circuit evaluation A and B, A or B**

# APT Quiz 1 Feb 23-27

- **Opens 2/23 1pm**
- **Closes at 11pm 2/27 – must finish all by this time**
- **There are two parts based on APTs 1-3**
  - Each part has two APT problems
  - Each part is 2 hours – more if you get accommodations
  - Each part starts in Sakai under tests and quizzes
  - Sakai is a starting point with countdown timer that sends you to a new apt page just for each part
  - Could do each part on different day or same days
- **Old APT Quiz so you can practice (not for credit) – on APT Page**



# CompSci 101, Spring 2023 APTs

Home | About | Dates | Labs | Assign | APTs | Help | Forms | Resources | Sakai

## APT Quiz

There will be two APT Quizzes that are just like APTs but are your own work and are timed. Start the APT quiz on Sakai under quizzes, but not until you are ready to take the quiz.

## APTs

**See below for hints on what to do if your APT doesn't run.**

For each problem in an APT set, complete these steps by the due date

- first click on the APT set below to go to the APT page.
- write the code, upload the file, select the problem, and click the **Submit** link
- **check your grade** on the grade code page by clicking on **check submissions**

In solving APTs, your program should work for all cases, not just the test cases we provide. We may test your program on addi data.

| APT | Due Date |
|---|---|
| APT-1 | January 26 |
| APT-2 | February 9 |
| APT-3 | February 23 |
| PRACTICE FOR APT QUIZ 1 | NOT FOR CREDIT |

We may do some APTs partially in class or lab, but you still have to do them and submit them. There will usually be extra You can do more than required to challenge yourself. We do notice if you do more APTs than those required. If you d APTs, they still have to be turned in on the due date.

## Regrades

If you have concerns about an item that was graded (lab, apt or assignment), you ve one week after the grade is posted to fill out the regrade form here.

## Problems Running an APT? Some Tips!

APT Quiz Info

Practice (old APT quiz)

Debugging Tips

Stuck! Use 7 steps!

Don't go to Sakai to start APT Quiz until you are ready to start

If you click on it, you start it!

# Tips for APT Quiz

- **Don't like the format, convert it:**
- **dig = "458"     Is variable dig a number?**
- **Use 7 steps**

## Tips for APT Quiz

- **Write a helper function**

- **Break code into parts**

# Problem 1

- **Write function addto. Given wordlist, a list of words and numlist, a list of integers, return a new list with a number from numlist in the same position attached to the end of each string. Repeat numbers from numlist in the same order if you need more numbers**
  - numlist = [3, 5, 6]
  - wordlist = ["on", "to", "a", "be", "some", "fa", "so"]
  - Result: ["on3", "to5", "a6", "be3", "some5", "fa6", "so3"]
  - def addto(wordlist, numlist):
- **How to solve:**

# WOTO-3: function addto
http://bit.ly/101s23-0223-3

# Practice for APT Quiz 1

**def addto(wordlist, numlist):**

# Problem 2

- **Write function update that has one parameter, a list of integers and/or words.**
- **This function makes a new list by starting with the original list  and adds 1 to each number in the list. The string returned is the sum of the modified numbers in the list, a colon, followed by the elements in the modified list, separated by a dash**
- **Example:**
  - update([1, 5, 'a', 2, 'z'])  returns  "11:2-6-a-3-z"
  - update([87, 'car', 11, 'be'])  returns "100:88-car-12-be"

## How to solve

## def update(alist):