## Presentation 23

## Generators

## Announcements for This Lecture

## Assignment 6

## Lesson Videos

- These are now graded
- Mean: 92, Median: 95
- Within expectations
- We removed hard part
- Limited regrades
- Again major issues only
- We are very behind here
- A7 is only thing left
- Almost all are posted
- Lesson 28 for today
- Lesson 29 next time


## Labs

- Today is more GUIs
- Generators will be Tues
- Coupled with coroutines


## From Last Time: More Buttons



Button is Up


Button is Down

## From Last Time: Composite Objects

- Way to "group" objects
- Has a single $x$, y attribute
- Moving obj moves all
- Code like subcontroller.py
- Each object is attribute
- Initialize them in $\qquad$ init

- Needs a custom draw
- Update not necessary
- Used in end of Task 1


## Activity: Call Frame Time

## Function Defintions

## Function Call

def rnginv(n): \#Inverse range >>> x = harmonic(2)
19 for x in range $(1, \mathrm{n})$ : Assume we are here:
20 yield $1 / x$
def harmonic(n): \#Harmonic sum
32 sum $=0$

| harmonic | n | 2 | 34 |
| :--- | :--- | :--- | :--- |
| $\operatorname{sum} \boxed{0}$ | \& id3 |  |  |

$33 \mathrm{~g}=\operatorname{rnginv}(\mathrm{n})$
34 for $x$ in g :
35 sum = sum $+x$
36 return x

## Ignoring the heap, what is the next step?

## Which One is Closest to Your Answer?



| rnginv | n | 2 |
| :---: | :---: | :---: |
| x | $\mathbf{1}$ |  |


| D: | harmonic |  | 2 | 3 |
| :---: | :---: | :---: | :---: | :---: |
|  | sum 0 | 8 id3 |  |  |
|  | rnginv |  | 2 | 2 |
|  | x 1 |  | YIEL | 1 |

Generators

## Which One is Closest to Your Answer?



## Activity: Call Frame Time

## Function Defintions

## Function Call

def rnginv(n): \#I
for $x$ in range(l,n):

| 19 | for x in rang |
| :---: | ---: |
| 20 | yield $\mathrm{l} / \mathrm{x}$ |

def harmonic(n): \#Harmonic sum
32 sum $=0$
$33 \mathrm{~g}=\operatorname{rnginv}(\mathrm{n})$
34 for x in g :
35 sum = sum $+x$
36 return x

## Which One is Closest to Your Answer?



| B: | harmoni |  | 2 | 34 |
| :---: | :---: | :---: | :---: | :---: |
|  | sum 0 | id3 |  |  |


| rnginv | n 2 | 20 |
| :---: | :---: | :---: |
| $\mathrm{x} \boxed{1}$ |  |  |


| D: | harmonic |  | 2 | 3 |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | sum 0 | g id3 |  |  |  |
|  | rnginv |  | 2 |  |  |
|  | $\mathrm{x} \quad 1$ |  | YIEL | 1 |  |

## Activity: Call Frame Time

## Function Defintions

## Function Call

| def $\operatorname{rnginv(n):~\# In~}$ |  |
| :--- | :---: |
| 19 for $x$ in $\operatorname{range}(1, n)$ : |  |

20 yield $1 / x$
def harmonic(n): \#Harmonic sum
32 sum $=0$
$33 \mathrm{~g}=\operatorname{rnginv}(\mathrm{n})$
34 for $x$ in g :
35 sum = sum $+x$
36 return x

## Which One is Closest to Your Answer?




| rnginv | n 2 | 19 |
| :---: | :---: | :---: |
| x 1 | YIELD | 1 |

D:

| harmonic | n 2 | 34 |
| :---: | :---: | :---: |
| sum 0 | g id3 |  |
| rnginv | n 2 |  |
| $\mathrm{x} \quad 1$ | RETURN | 1 |

## Activity: Call Frame Time

## Function Defintions

## Function Call

def rnginv(n): \#Inverse range >>> x = harmonic(2)


20 yield $1 / \mathrm{x}$
def harmonic(n): \#Harmonic sum
32 sum $=0$
$33 \mathrm{~g}=\operatorname{rnginv}(\mathrm{n})$
34 for $x$ in g :
35 sum = sum $+x$
36 return x

| D: | harmonic | $\mathrm{n} \mid 2$ | $\mathbf{3 4}$ |
| :--- | :--- | :--- | :--- |
| sum | 0 | \& | id3 |
|  |  |  |  |
|  |  |  |  |

rnginv


## What is the next step?

## Which One is Closest to Your Answer?



## Activity: Call Frame Time

## Function Defintions

## Function Call

def rnginv(n): \#In
for $x$ in range(l, $n)$ :

| 19 | for x in rang |
| :--- | :--- |
| 20 | yield $\mathrm{l} / \mathrm{x}$ |

def harmonic(n): \#Harmonic sum
32 sum $=0$
$33 \mathrm{~g}=\operatorname{rnginv}(\mathrm{n})$
34 for x in g :
35 sum = sum $+x$
36 return x

## Which One is Closest to Your Answer?

| A: | harmonic |  | n 2 |  |  | 34 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | sum 1 | g | id3 |  | x 0 | 0.5 |


| B: | harmonic | n | 2 |  |
| :--- | :--- | :--- | :--- | :--- |
|  | $\mathbf{3 4}$ |  |  |  |
| sum | l | g | id3 | x |
|  | l |  |  |  |


| $\mathrm{C}:$ | harmonic | n | 2 |  |
| :--- | :--- | :--- | :--- | :--- |


| rnginv | n 2 | 19 |
| :---: | :---: | :---: | :---: |
| $\mathrm{x} \square \mathrm{l}$ |  |  |


| D: | harmonic | n | 2 | $\mathbf{3 4}$ |
| :--- | :--- | :--- | :--- | :--- |
|  |  |  |  |  |


rnginv
n 2 20
x 2

## Activity: Call Frame Time

## Function Defintions

## Function Call

def rnginv(n): \#Inverse range >>> x = harmonic(2)


20 yield $1 / \mathrm{x}$
def harmonic(n): \#Harmonic sum
32 sum $=0$
$33 \mathrm{~g}=\operatorname{rnginv}(\mathrm{n})$
34 for x in g :
35 sum = sum +x
36 return x

## Which One is Closest to Your Answer?



| B: | harmon |  |  |  |  | 34 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | sum 1 | g | id 3 |  |  | 1 |


| rnginv | n | 2 |
| :---: | :---: | :---: |
| x | 19 |  |


| D: | harmonic | n | 2 |  |
| :--- | :--- | :--- | :--- | :--- |
|  | $\mathbf{3 4}$ |  |  |  |
| sum | 0 | g | id3 | x |
|  | l |  |  |  |


| rnginv | $\mathrm{n} \boxed{2}$ | 20 |
| :---: | :---: | :---: |
| $x \boxed{2}$ |  |  |

## Activity: Call Frame Time

## Function Defintions

## Function Call

| def $\operatorname{rnginv(n):~\# In~}$ |  |  |
| :--- | :---: | :---: |
| 19 for $x$ in $\operatorname{range}(1, n)$ : |  |  |

20 yield $1 / x$
def harmonic(n): \#Harmonic sum
32 sum $=0$
$33 \mathrm{~g}=\operatorname{rnginv}(\mathrm{n})$
34 for $x$ in g :
35 sum = sum $+x$
36 return x

## Functions to Generators

def harmonic(n):
IIIII
Generates the partial sums of the harmonic series up $1 / n$

The partial sum for $k$ is $1+1 / 2+1 / 3+\ldots+1 / k$

Parameter n: The range bounds
Precondition: n is an int $>0$
IIIII
pass

## Chaining Generators

def sumfold(input):
IIIII
Generates the sums of the numbers seen so far in input

Example: sumfold([1,2,3]) generates the numbers 1, 3, and 6

Parameter input: The input data to sum
Precondition: input is a iterable of numbers (int or float) """
pass

## Chaining Generators

def sumfold(input):
IIIII
Generates the sums of the numbers seen so far in input

Example: sumfold([1, 2, $3 \longdiv { \begin{array} { c } { \text { For maximum } } \\ { \text { flexibility } } \end{array} }$ pers 1,3 , and 6
Parameter input: The inptoy
Precondition: input is a iterable of numbers (int or float) """
pass

## Chaining Generators

def filterdiv(input,n):
"""Generates all elements of input evenly divisble by n

The elements are generated in the order they appear in input.

Example: filterdiv([1,2,3,4],2) generates the numbers 2 and 4

Parameter input: The input data to filter
Precondition: input is a iterable of int

Parameter n: The number to divide by
Precondition: n is an int"""
pass

## Questions?

