

ACM India at a Glance



- [ACM](#): world's largest educational and scientific computing society
 - **Mission**: advancing computing as science and profession
 - **Members**: ~100,000 worldwide, ~13000 in India
 - Comprising students, faculty, professionals
- [ACM India Chapters](#): ~200 student chapters, ~20 professional chapters
- [ACM-W India](#): empowering women in computing
- **Research Initiatives**
 - Student research: [ARCS Symposium](#), [best doctoral dissertation](#), [partial travel grant](#), [PhD clinic](#) and [Anveshan Setu](#)
 - SIG research conferences: [CODS-COMAD](#), [ISEC](#)
- [ACM India Annual Event](#)
 - Discuss recent trends in technology and celebrate India's achievements in computing
- **Education Initiatives**
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 - [Compute](#): Symposium on computing education
 - [Teaching Partner Program](#): External experts offering a course
 - [CSpashala](#): inculcate computational thinking in schools
- **Learning and Professional Development**
 - [Eminent Speaker Program](#)
 - [Industry Webinars](#), [Education Webinars](#)
 - [Minigraphs](#): Comprehensive coverage of a tech area
 - ACM global resources: [Digital Library](#), [ACM Learning Center](#)
- [New prestigious awards instituted](#)
 - Acknowledge and celebrate outstanding contributions
- **ACM Membership in India**
 - Student? [student member form](#)
 - Professional? [professional member form](#)

Increasing use of Active Learning in Computing

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Problem

- Many courses use passive learning rather than active
 - Large failure rates
 - Students with less prior experience more at risk of failing
- Active Learning can improve student learning, motivation, and retention
 - Piaget – constructivism – students learn by constructing knowledge
 - Vigotsky – social learning – students learn best when interacting with others
 - Papert – constructionism – learning is most effective when creating a meaningful product



Research Projects

- Free and interactive ebooks on Runestone
- Mixed up code (Parsons) problems
- Support for Peer Instruction

py4e-int Saving and Logging are Disabled

Python for Everybody - Interactive Assignments

• [Assignments](#)

Construct a block of code that asks the user for a number and prints three times that number. There is extra code to watch out for.

Drag from here

1a | `userNumber = input(prompt)`

1b | `user number = input(prompt)`

2a | `print(3 * userNumber)`

2b | `print(3 * int(userNumber))`

3 | `prompt = 'Please enter a number\n'`

4 | `print(userNumber)`

Drop blocks here

3 | `prompt = 'Please enter a number\n'`

1a | `userNumber = input(prompt)`

2b | `print(3 * int(userNumber))`

Check Reset Help me

Parsons (var-input-pp-prompt)

Peer Instruction Question

Please Give an explanation for your answer

Then discuss your answer with your group members

What programming language does this site help you to learn?

- A. Python
- B. Java
- C. C
- D. ML

Thanks, your answer is recorded.

Activity: 2.1.1 Multiple Choice (question1_1)

Your answer B

peer2 answered C

Please discuss the answers with your group members

Send

peer2: Hello World! C is the correct answer!!

Not so fast peer2, in the immortal words of the bard, 2 B or 1 2 B

peer2: OK, but maybe we should consider Python?

Please provide a confidential rating of peer2's explanation

- Poor
- Good
- Excellent

Runestone Academy

- Founder
 - *Democratizing textbooks for the 21st century*
 - *Everyone should be able to learn computing*
 - Started with one ebook in 2011
 - Now 30+ for computing and math
 - Average of 2 million page views a week
 - Top 1% of websites in the world

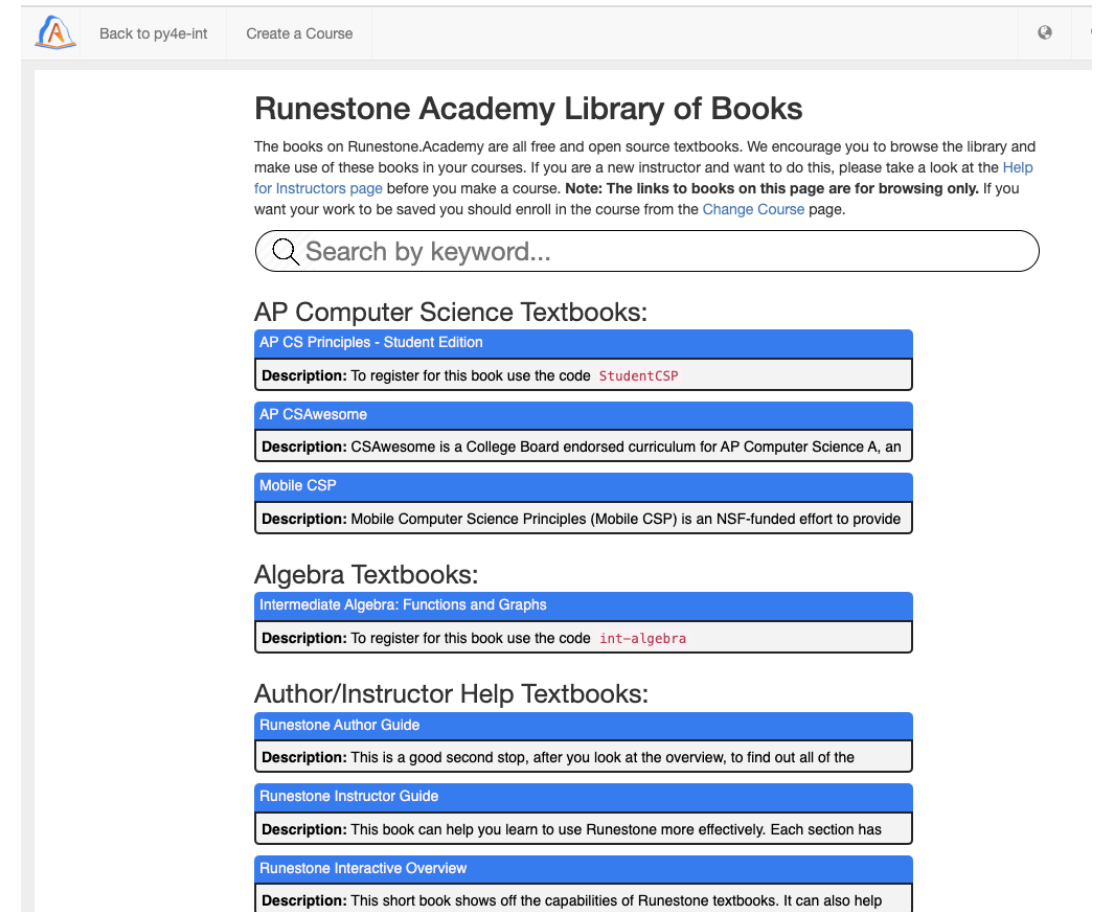
Brad Miller



List of Ebooks on Runestone

<https://tinyurl.com/a48adr85>

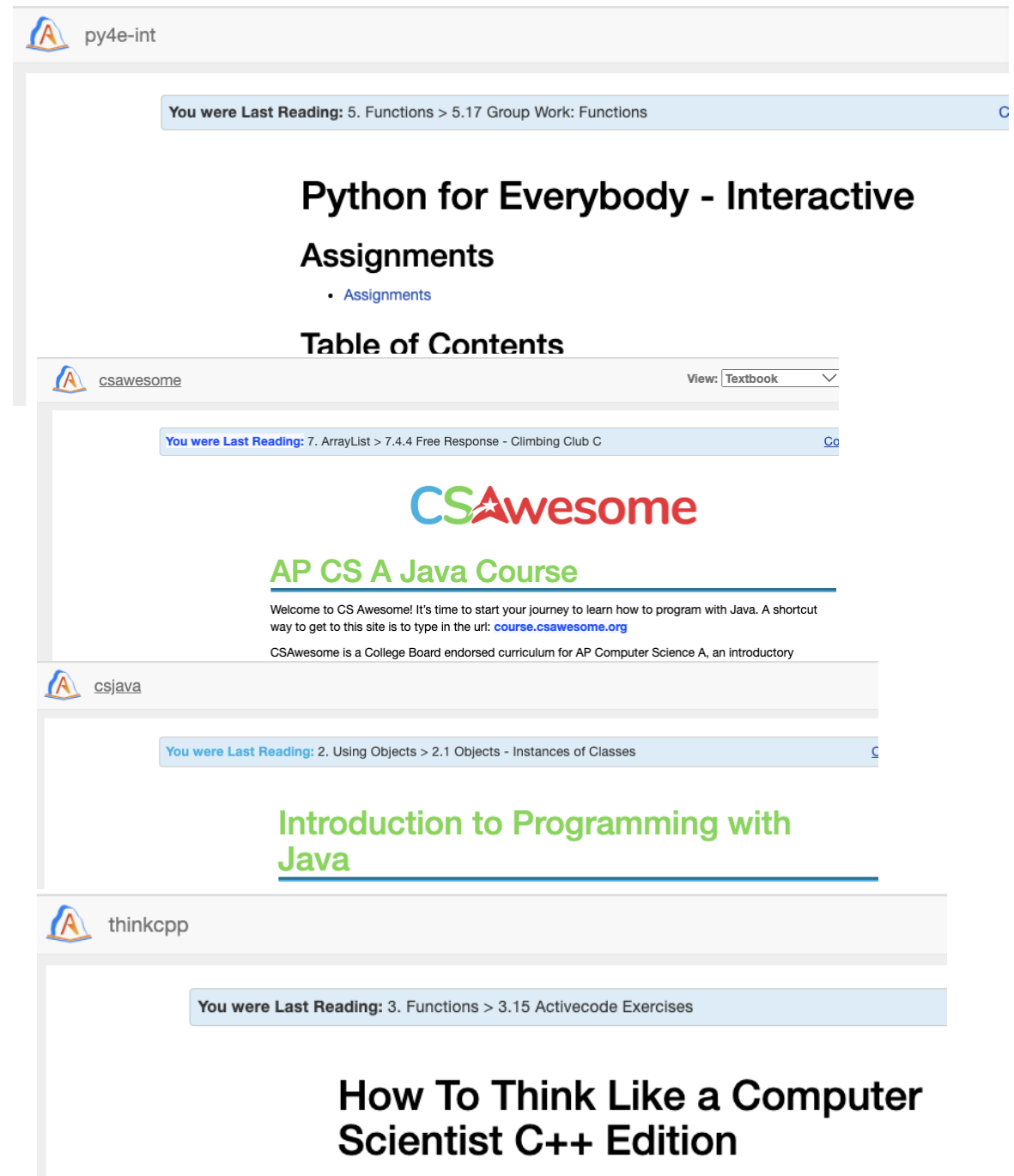
- 30+ free ebooks for computing and math



The screenshot shows the Runestone Academy Library of Books website. At the top, there are navigation links: "Back to py4e-int" and "Create a Course". The main heading is "Runestone Academy Library of Books". Below the heading is a paragraph of introductory text: "The books on Runestone.Academy are all free and open source textbooks. We encourage you to browse the library and make use of these books in your courses. If you are a new instructor and want to do this, please take a look at the [Help for Instructors page](#) before you make a course. **Note: The links to books on this page are for browsing only.** If you want your work to be saved you should enroll in the course from the [Change Course page](#)." Below the text is a search bar with the placeholder "Search by keyword...". The content is organized into three main sections: "AP Computer Science Textbooks:", "Algebra Textbooks:", and "Author/Instructor Help Textbooks:". Each section lists several books with their titles and descriptions. The books listed are: "AP CS Principles - Student Edition" (Description: To register for this book use the code `StudentCSP`), "AP CSAwesome" (Description: CSAwesome is a College Board endorsed curriculum for AP Computer Science A, an), "Mobile CSP" (Description: Mobile Computer Science Principles (Mobile CSP) is an NSF-funded effort to provide), "Intermediate Algebra: Functions and Graphs" (Description: To register for this book use the code `int-algebra`), "Runestone Author Guide" (Description: This is a good second stop, after you look at the overview, to find out all of the), "Runestone Instructor Guide" (Description: This book can help you learn to use Runestone more effectively. Each section has), and "Runestone Interactive Overview" (Description: This short book shows off the capabilities of Runestone textbooks. It can also help).

My Current Ebooks

- Python for Everybody – Interactive (py4e-int)
- CSAwesome (csawesome)/CSJava (csjava)
- How to Think Like a Computer Scientist – C++ (thinkcpp)
- Student CSP (StudentCSP)
- Discrete Math (dmoi)




The screenshot displays a web browser interface for the 'py4e-int' website. At the top, a navigation bar shows the site's logo and name. Below this, a breadcrumb trail indicates the current page: 'You were Last Reading: 5. Functions > 5.17 Group Work: Functions'. The main content area features the title 'Python for Everybody - Interactive Assignments' in a large, bold font, followed by a link to 'Assignments'. Below the title is a 'Table of Contents' section. The browser's address bar shows the URL 'csawesome' and a 'View: Textbook' dropdown menu. A second breadcrumb trail is visible: 'You were Last Reading: 7. ArrayList > 7.4.4 Free Response - Climbing Club C'. The main content area displays the 'CSAwesome' logo, the title 'AP CS A Java Course', and a welcome message: 'Welcome to CS Awesome! It's time to start your journey to learn how to program with Java. A shortcut way to get to this site is to type in the url: course.csawesome.org'. Below this, it states: 'CSAwesome is a College Board endorsed curriculum for AP Computer Science A, an introductory'. The browser's address bar shows the URL 'csjava'. A third breadcrumb trail is visible: 'You were Last Reading: 2. Using Objects > 2.1 Objects - Instances of Classes'. The main content area displays the title 'Introduction to Programming with Java'. The browser's address bar shows the URL 'thinkcpp'. A fourth breadcrumb trail is visible: 'You were Last Reading: 3. Functions > 3.15 Activecode Exercises'. The main content area displays the title 'How To Think Like a Computer Scientist C++ Edition'.

Interactive Ebooks

- Educational Psychology
 - Interleaved worked examples plus practice problems - Sweller
 - Assessments with immediate feedback

```
Run Original - 1 of 1 Audio Tour
1 from turtle import * # use the turtle library
2 space = Screen() # create a turtle space
3 alex = Turtle() # create a turtle named alex
4 alex.forward(150) # move forward by 150 units
5 alex.left(90) # turn left 90 degrees
6 alex.forward(75) # move forward by 75 units
7
```



csp-5-1-1: Which way does a turtle face when it is first created?

- A. North
- B. South
- C. East
- D. West

Check Me

Compare me

✘ The turtles in some of the examples faced north because of the `setheading(90)` instruction. Which way does chad move first?

Multiple-Choice Questions

Single correct or multiple-correct

Q-3: Which of the following is a Boolean expression? Select all that apply.

- A. True
- B. `3 == 4`
- C. `3 + 4`
- D. `3 + 4 == 7`
- E. "False"

✓

- A. True and False are both Boolean literals.
- B. The comparison between two numbers via `==` results in either True or False (in this case False), both Boolean values.
- D. `3 + 4` evaluates to 7. `7 == 7` then evaluates to True, which is a Boolean value.

Activity: 4.1.3 Multiple Choice (cndtnl-bool-mc-expression)

csp-10-2-5: What is printed when the following statements execute?

```
day = "Thursday"
day = 32.5
day = 19
print(day)
```

- A. Nothing is printed. A runtime error occurs.
- B. Thursday
- C. 32.5
- D. 19

✓ The current value of the variable day will be printed.

Activity: 2.15.5 Multiple Choice (var-ex-mc-assign)

Fill in the Blank

Uses a regular expression to check the answer

Q-3: What is the name of the data type that represents Boolean values?

[Check me](#) [Compare me](#)

Correct! They are called "bool", with an uncapitalized B.

Activity: 4.14.1.3 Fill in the Blank (cond_fitb_pogil_booltype)

Q-18: What character indicates that what follows next is the body of the function?

[Check me](#) [Compare me](#)

A : is used to indicate the start of the body of a function.

Activity: 5.17.5.1 Fill in the Blank (funct_fitb_body_char)

Matching

Drag terms to definitions

Q-12: Drag each term to its definition

function header	All of the code that tells the program what to do when the function is executed. It includes the header and body.
function call	function definition
function name	Follows the def keyword and is before the list of arguments in ().
function body	The name of the function followed by an argument list in ().
	The first line of a function definition
	All of the lines in the function after the function header

[Check me](#) [Reset](#)

Activity: 5.17.2.3 Drag-N-Drop (function_def_dnd_v3)

Clickable Code

Click on code to answer a question

- Highlights correct and incorrect answers

Q-11: Click on all of the function names in the code below.

```
# function definition
def print_message():
    print("Welcome to Python.")
    print("Learn the power of functions!")

# function definition
def main():
    print("Hello Programmer!")

# function call
print_message()

# function call
main()
```

Check Me

Incorrect. You clicked on 2 of the 2 correct elements and 1 of the 8 incorrect elements. The name of the function is after the def keyword and before the ().

Activity: 5.17.2.2 Clickable (funct_ca_click_names)

Codelens with Optional Predictions

Step through code

- Visualize variable values

Python 3.6

```
1 # function definition
2 def test(a, b = 2):
3     print("Welcome")
4     print("Learn the power of fun
5     print(a + b)
6     print(a - b)
7     print(a * b)
8     print(a / b)
9     print(a // b)
10    a = 5 % 2
11    return a
12
13 # function definition
14 def main():
15     print("Hello!")
16
17 # function call
18 print(test(3))
```

[Edit this code](#)

→ line that just executed
→ next line to execute

Print output (drag lower right corner to resize)

```
Welcome
Learn the power of functions!
5
```

Frames

Global frame

- test
- main

Objects

function test(a, b)
default arguments:

- b 2

main

function main()

test

a	3
b	2

Write Code - ActiveCode

- Executable and editable
 - Python (JavaScript), C++, Java, SQL
- Can have unit tests



```
1 friends = ['Joseph', 'Glenn', 'Sally']
2 for friend in friends:
3     print('Happy New Year:', friend)
4 print('Done!')
5
```

Save & Run

Given a database of bike share information fix the SELECT statement to retrieve the `bike_number` and `duration` from table `trip_data` for `bike_number` "W00837".

Save & Run

7/30/2022, 1:10:22 PM - 5 of 5

Share Code

```
1 SELECT bike_number, duration from trip_data WHERE bike_number = 'W00837'
2
```

```
Pass: W00837 == W00837 in row 0 column bike_number
Pass: 1577 == 1577 in row 0 column duration
Pass: W00837 == W00837 in row 1 column bike_number
Pass: 110 == 110 in row 1 column duration
Pass: W00837 == W00837 in row 3 column bike_number
Pass: 3398 == 3398 in row 3 column duration
Pass: W00837 == W00837 in row 7 column bike_number
Pass: 1836 == 1836 in row 7 column duration
Pass: W00837 == W00837 in row 13 column bike_number
Pass: 492 == 492 in row 13 column duration
You passed 10 out of 10 tests for 100%
```

Audio Tours of Code

- Highlight a line or lines as audio plays explaining the code

program and the Load button will load a saved program.

The screenshot shows a code editor interface with a light blue background. At the top right, there are two buttons: "Save & Run" (green) and "Load History" (dark grey). Below these is a code editor with a white background and a light grey border. The code is as follows:

```
1. height = 60 # in inches (60 inches is 5 feet)
2. weight = 110 # in pounds
3. heightSquared = height * height
4. BMI = weight / heightSquared
5. BMImetric = BMI * 703
6. print("BMI:")
7. print(BMImetric)
8.
```

The first line of code is highlighted in yellow. Below the code editor, there are five navigation icons: a double left arrow, a single left arrow, a vertical bar (play/pause), a single right arrow, and a double right arrow. Below these icons is a light blue button labeled "Playing the Line-by-line Tour". At the bottom, there are two buttons: "Line-by-line Tour" (green) and "Stop tour" (dark grey).

Timed Exams

- Can set a time limit
- Can include
 - Multiple choice
 - Fill in the blank
 - Parsons
 - Write Code with Unit Tests
- Autograded
 - Can also manually grade
- Can have a list of problems for each question
 - Pick one at random

Mid2-Win22-Timed

Due: 2022-06-09 00:00:00

Description: Self Grade: 0 of 225 = 0.0%

This assignment has not been started

Questions

Time Remaining 80:00

Start

This assignment has not been started

Mid2-Win22-Timed

Due: 2022-06-09 00:00:00

Description: Self Grade: 0 of 225 = 0.0%

This assignment has not been started

Questions

Time Remaining 79:38

Warning: You will not be able to continue the exam if you close this tab, close the window, or navigate away from this page! Make sure you click the Finish Exam button when you are done to submit your work!

Prev Next

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

31 32

Flag Question

Q-1: What will be printed when the following code is executed?

```
nums = [1, 91, 101, 11]
print(sorted(nums, reverse = True))
```

A. [1, 11, 91, 101]

B. [101, 91, 11, 1]

C. [91, 11, 101, 1]

D. [1, 11, 101, 91]

Spaced Practice Tool

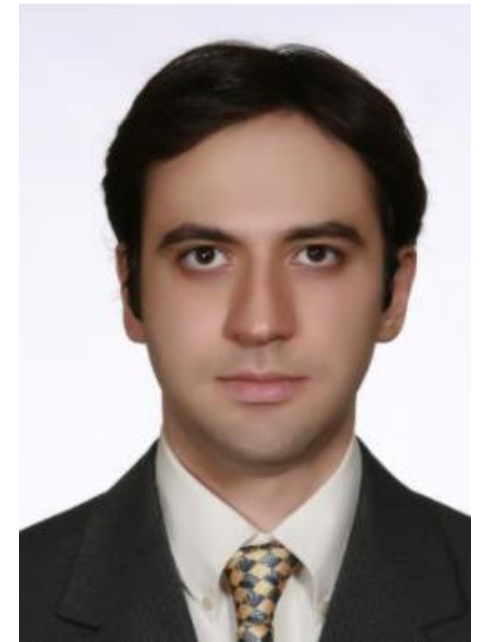
- Give x points for solving y number of problems a day over z days
- Predicts when you are about to forget a topic
- Each hour of practice was associated with a 1% increase in the final grade

7 questions left to get today's point.
48 more questions available to practice today.
You have completed 19 days out of 45 days of your review practice.
24 days are remaining to the end of the semester.

modules-2-1: The correct code to generate a random number between 1 and 100 (inclusive) is:

- A. `prob = random.randrange(1, 101)`
- B. `prob = random.randrange(1, 100)`
- C. `prob = random.randrange(0, 101)`
- D. `prob = random.randrange(0, 100)`

Iman Yeckehzaare



YeckehZaare, Resnick, and Ericson, 2019, A Spaced, Interleaved Retrieval Practice Tool that is Motivating and Effective, ICER

Features for Instructors

- Create a custom course from any existing ebook
 - Have students register for that course
 - <https://tinyurl.com/y6uhbvnM>
- Create assignments
 - From existing readings and problems
 - Or create new problems
- Automatically Grade Assignments
- Instructor guide (instructorguide) <https://tinyurl.com/5n99fbtn>

Build a Custom Course

For Instructors ONLY If you are an independent learner you DO NOT need to build your own course. answers, YOU ARE WRONG.

This page allows you to select a book for your own class. Once you have selected and built the book, publish right in the book. As the instructor, You can grade your students homework, and have access name below. Selecting an appropriate course level will help us to recommend questions and practice

Course Name

This will be the name your students use when they register. Make it one word, short (no spaces)

Description

Institution

Course Level

Fall22-SI206

[Student Progress](#) [Admin](#) [Grading](#) [Assignments](#) [Practice](#) [Help/Documentation](#)

Grade Book

Chapter Activity

Course Settings

Manage Students

Add TA

Download Log

Students Online

Reset Student Exam

Copy Assignments

LTI Integration

Delete

Runestone News

Recent Updates (December 29, 2021) Expect downtime and bugs!!

- Changing DNS entries 12/29 evening. If all goes well you shouldn't notice anything. You will suddenly just end up using a new server.
- Database Moved to its own secure server
- Move to modern [scalable architecture](#)
- New Bookserver coming online this week
- Please report bugs on [Github](#)

High School Teachers:

We want you to use Runestone! But before your school district sends me a contract to sign, please read [This letter](#)

Planning for 2021/22?

Several instructors have contacted me about budgeting for Runestone in the next school year! Thank you! If you are able to include any amount of support for Runestone in your budget for next year that would be awesome! Some departments have even added a \$10/student lab fee to help support Runestone! I am happy to send you an invoice!

If you are curious about Runestone's finances, I am as transparent as possible. please see [The Runestone Annual Report](#)

Support Runestone

Did you know that over 50,000 students have registered on Runestone Academy since August 1 2020!? At \$100 a textbook we have saved students over \$5 million! Thats a lot of students and a lot of savings. Please consider a [donation](#) to help pay for server costs and the ongoing development needed to keep runestone online.

A huge **Thank You!** to those of you who have sent your support already.

Research on Ebooks

- Better learning gains than a static ebook - Pollari-Malmi et al 2017
- Increase in student performance and satisfaction - Croft and England 2019
- Reading time in an ebook does not always correlate with performance - interaction time is better - Smith et. al. 2021
- Can use ebook data to identify struggling students - Gökhan et al 2019
- Teachers who used more of the interactive features and spent more time in an ebook had higher confidence in their ability to teach the material - Ericson et al 2016

Free Online Courses – Python

- Expressing yourself in Python
 - <https://tinyurl.com/2npzamhn>
- The Power of Object-Oriented Programming
 - <https://tinyurl.com/3ujekjv9>
- Debugging: Hunting and Squashing Bugs
 - <https://tinyurl.com/3tefuj92>



Subjects ▾ Courses ▾ FL Business

Online Courses / IT & Computer Science



Big Ideas in Programming: Expressing Yourself with Python

Harness the power of Python and its programming concepts to express yourself and automate the work you do.



Subjects ▾ Courses ▾ FL Business

Online Courses / IT & Computer Science



The Power of Object-Oriented Programming

Extend your Python knowledge and programming skills with this engaging object-oriented programming course.

Parsons Problem

- Has a problem description
- Code fragments that must be placed in order
- Can require indentation as well
- Can have distractor blocks
- Should be less cognitive load than writing the code

Construct a block of code that asks the user for a number and prints three times that number. There is extra code to watch out for.

Drag from here

Drop blocks here

1a | `userNumber = input(prompt)`

or

1b | `user number = input(prompt)`

2a | `print(3 * userNumber)`

or

2b | `print(3 * int(userNumber))`

3 | `prompt = 'Please enter a number\n'`

4 | `print(userNumber)`

3 | `prompt = 'Please enter a number\n'`

1a | `userNumber = input(prompt)`

2b | `print(3 * int(userNumber))`

Check Reset Help me

Parsons (var-input-pp-prompt)

Adaptive Parsons Problems

- Intra-problem
 - If the learner is struggling to solve the current problem
 - Remove Distractors
 - Provide Indentation*
 - Combine Blocks

The screenshot shows a web browser window with the URL `stone.academy/runestone/books/published/StudentCSP/CSPRepeatTurtles/turtleGeom.html`. The page title is "turtleCSP" and it shows "This Chapter" with a dropdown arrow. There are two buttons: "Check Me" and "Compare me". Below these is a yellow banner with the text "Activity: 4 -- Multiple Choice (10_2_1_Turtle_Dodecagon_Q1)".

The main content area has a title "csp-10-2-2: The following program uses a turtle to draw a triangle as shown to the left, but the lines are mixed up. The program should do all necessary set-up and create the turtle. After that, iterate (loop) 3 times, and each time through the loop the turtle should go forward 100 pixels, and then turn left 120 degrees." To the left of this text is a small diagram of a triangle. Below the text is the instruction: "Drag the needed blocks of statements from the left column to the right column and put them in the right order with the correct indentation. There may be additional blocks that are not needed in a correct solution. Click on *Check Me* to see if you are right. You will be told if any of the lines are in the wrong order or are the wrong blocks."

Below the instruction are two columns. The left column is labeled "Drag from here" and contains six pairs of code blocks, each with a radio button and a label:


- 1a `marie.forward(100)` (radio button selected)
- 1b `marie.forward(100)`
- 2 `marie = Turtle()`
- 3a `# repeat 3 times
for i in range(3)`
- 3b `# repeat 3 times
for i in range(3):`
- 4a `marie.left(120)`
- 4b `marie.turn(120)`
- 5 `from turtle import *`
- 6a `space = Screen()`
- 6b `space = screen()`

The right column is labeled "Drop blocks here" and is a large yellow rectangular area. At the bottom of the page are three buttons: "Check", "Reset", and "Help me". Below these is a yellow banner with the text "Activity: 5 -- Parsons (10_2_2_Triangle)".

Adaptive Parsons Problems

- Inter-problem
If user solved the last one easily, make the next one harder

csp-10-2-2: The following program uses a turtle to draw a triangle as shown to the left, but the lines are mixed up. The program should do all necessary set-up and create the turtle. After that, iterate (loop) 3 times, and each time through the loop the turtle should go forward 100 pixels, and then turn left 120 degrees.



Drag the needed blocks of statements from the left column to the right column and put them in the right order with the correct indentation. There may be additional blocks that are not needed in a correct solution. Click on Check Me to see if you are right. You will be told if any of the lines are in the wrong order or are the wrong blocks.

Drag from here

```
1 | marie = Turtle()  
2 | space = Screen()  
3 | space = screen()  
4 | marie.turn(120)  
5 | marie.left(120)  
6 | from turtle import *  
7 | # repeat 3 times  
  | for i in range(3):  
8 | # repeat 3 times  
  | for i in range(3)  
9 | marie.forward(100)  
10| marie.forward(100
```

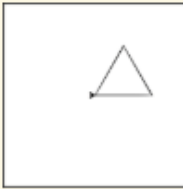
Drop blocks here

Don't show distractors as paired and use all distractors

Check Me Reset Help Me

If many attempts, remove some distractors and pair them with the correct code

csp-10-2-2: The following program uses a turtle to draw a triangle as shown to the left, but the lines are mixed up. The program should do all necessary set-up and create the turtle. After that, iterate (loop) 3 times, and each time through the loop the turtle should go forward 100 pixels, and then turn left 120 degrees.



Drag the needed blocks of statements from the left column to the right column and put them in the right order with the correct indentation. There may be additional blocks that are not needed in a correct solution. Click on Check Me to see if you are right. You will be told if any of the lines are in the wrong order or are the wrong blocks.

Drag from here

```
1 | marie = Turtle()  
2 | from turtle import *  
3 | # repeat 3 times  
  | for i in range(3):  
4 | marie.forward(100)  
5a| marie.turn(120)  
  | or  
5b| marie.left(120)  
6a| space = Screen()  
  | or  
6b| space = screen()
```

Drop blocks here

Remove some distractors and pair the rest with the correct code

Check Me Reset Help Me

Parsons Problem Findings

- Significantly faster to solve Parsons than fix code or write code
 - similar learning gains
- Students ~2x as likely to solve adaptive Parsons problems
- Teachers felt they helped them learn to fix and write code
- Most students find Parsons useful for learning to program
 - Some prefer to write code from scratch

Construct a block of code that prints the numbers 1 through 10, but skips the number 8. The loop will start by incrementing n, before doing anything else. Look out for the three extra code pieces and watch your indentation!

Drag from here

```
1 | continue
2 | n = 0
3a | if n == 8:
3b | if n = 8:
4 | n = n + 1
5a | while (n < 10):
5b | while (n <= 10):
6 | print(n)
```

Drop blocks here

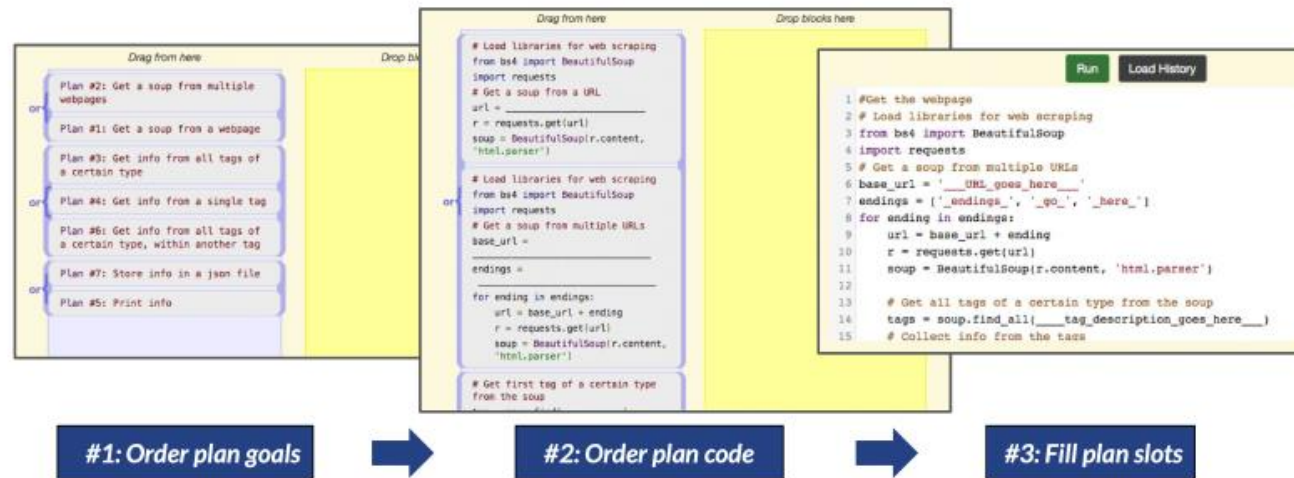
Solution

```
2 | n = 0
5a | while (n < 10):
4 | n = n + 1
3a | if n == 8:
1 | continue
6 | print(n)
```

Check Reset Help me

Purpose-First Programming

- Conversational Programmers
 - Don't want to trace code
 - Don't want to be software developers
 - Liked learning at the plan level
 - With real-world code



Kathryn Cunningham



Cognitive Load and Efficiency of Parsons Problems versus Write Code

- Within-subjects study with undergraduate students
 - Lower mean cognitive load for Parsons
 - Not always significant
 - Lower median time to solve for Parsons
 - Not always significant – unusual solution
 - Ordering effect if solved unusual solution first
- Think-aloud observations of 11 students
 - Some hate Parsons problems
- Study with neurodiverse students

Carl Haynes-Magyar



Toggle Parsons Problems

- Users can solve either the Parsons problem
 - Or toggle to solve the equivalent write code problem with unit tests
- Grades whichever one the user leaves selected

The screenshot shows a coding platform interface. At the top, a dropdown menu is set to "Parsons Mixed-Up Code - Classes_Basic_Airport_pp". Below this, the problem description is repeated: "Create a class `Airport` with an `__init__` method that takes a `name` and `code` as strings and initializes these attributes in the current object. Then define the `__str__` method to return the `name code`. For example, `print(a)` when `a = Airport('Detroit', 'DTW')` would print `Detroit DTW`." The interface is split into two modes: "Parsons" (selected) and "Write Code". In Parsons mode, code blocks are draggable from a "Drag from here" column to a "Drop blocks here" column. The blocks include: `def __init__(self, name, code):`, `def __init__(name, code):`, `return name + " " + code`, `return self.name + " " + self.code`, `class Airport:`, `def Airport:`, `self.name = name`, `self.code = code`, `def __str__(self):`, and `def str(self):`. In Write Code mode, the code editor shows the following code:

```
class Airport:
    def __init__(self, name, code):
        self.name = name
        self.code = code
    def __str__(self):
        return f'{self.name} {self.code}'

a = Airport("Detroit", "DTW")
print(a)
```

 The output of the code is "Detroit DTW". Below the code editor is a table with the following data:

Result	Actual Value	Expected Value	Notes
Pass	'Detroit DTW'	'Detroit DTW'	testing __str__ for Detroit
Pass	'Atlanta ATL'	'Atlanta ATL'	testing __str__ for Atlanta

At the bottom, it says "You passed: 100.0% of the tests".

Horizontal Parsons Problem for Regex

Your regular expression:

Drag or click to select from the symbols below to form your regex

* \w [a-z] [aeiou] [^aeiou]

Regex:

Test cases passed:
0/9

Feel free to experiment with your own test cases.

Match:

unicorn
element

Reset

Do not match:

banana
apple

Reset

Horizontal Parsons Problems vs Text Entry

Zihan Wu

- Within-subjects think-aloud study
 - Horizontal Parsons are easier than text entry
 - Parsons problems are more limiting
- Between subjects-study optional assignment in a MOOC
 - Text entry condition had a significantly higher drop-out rate
 - Parsons condition had higher learning gains on the meaning of symbols and took less time to complete



Parsons as Hint While Writing Code

- When writing code
 - Can pop-up a Parsons problem
- Must still solve the write code problem

The image shows a coding environment with a Parsons problem pop-up. The background is a problem page for 'Parsons Mixed-Up Code - has22_Parsons-Version-A'. The pop-up window contains the following text:

Close Preview

Create the function `has22(nums)` below to return `True` if there are at least two items in the list `nums` that are adjacent and both equal to `2`, otherwise return `False`. For example, return `True` for `has22([1, 2, 2])` since there are two adjacent items equal to `2` (at index 1 and 2) and `False` for `has22([2, 1, 2])` since the `2`'s are not adjacent.

Drag from here

```
1 def has22(nums):
2a for i in range(len(nums) - 1):
or 2b for i in range(len(nums)):
3a if nums[i] == 2 and nums[i + 1] == 2:
or 3b if nums[i] == nums[i + 1]:
4 return True
5 return False
```

Drop blocks here

Check Reset Help me

Problem: 1 -- Parsons (has22_Parsons-Version-A)

The background problem page shows a progress bar with 9 items, where item 9 is 2 (33.3%) and the others are 0 (0%). It also shows a code editor with the function signature `def has22(nums):` and a 'Run' button.

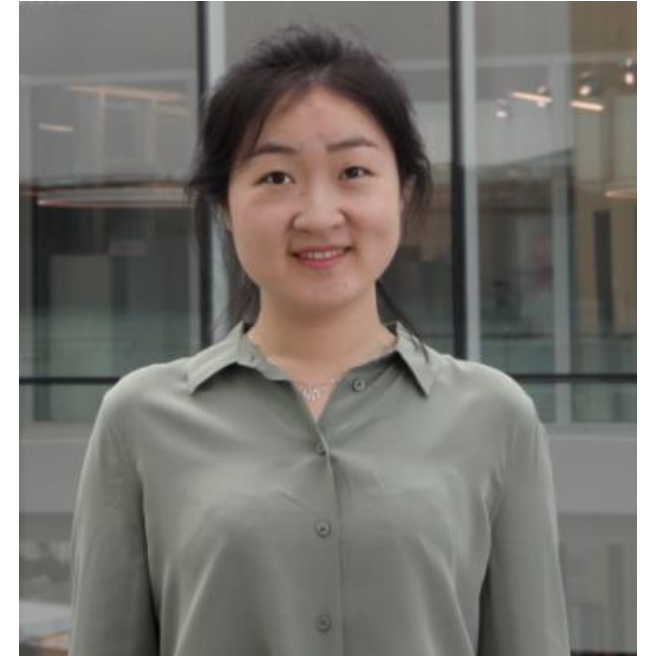
Parsons as Hint While Writing Code

- Think aloud study – 11 students
 - Targeted help vs search
 - Right direction
 - Syntax reminder
 - Makes me think
- Between-subjects study
 - Group in hint condition had better learning gains on write code problems

Xinying Hou



Xu Wang



ITiCSE Working Group on Parsons Problems

- Extensive Literature Review
- Studies in a Box
 - Python 3 + Lists and Dictionaries – Parsons vs Write Code
 - <https://tinyurl.com/2p8t6yup>
 - Python 3 + Lists and Dictionaries – Write Code vs Write Code with Parsons as Scaffolding
 - <https://tinyurl.com/2af62pad>
 - Python 3 + Classes – Parsons with Distractors vs without
 - <https://tinyurl.com/yedw2xxv>

Peer Instruction

- Eric Mazur from Harvard
 - Realized that students could solve textbook problems in Physics
 - But couldn't apply what they knew in real-world situations
 - Students do better if they discuss their answers with each other



Peer Instruction Process

- Students read material before lecture (optional)
- Assessment before or at the beginning of lecture (optional)
- Instructor displays a hard multiple-choice question every 15 - 20 minutes
 - Students answer individually
 - Students discuss answers with peers
 - Students answer individually again
 - Instructor shows the results of both answers and leads a discussion

Catherine H Crouch and Eric Mazur. “Peer instruction: Ten years of experience and results”. In: *American journal of physics* 69.9 (2001), pp. 970–977.

Research on Peer Instruction

- Twice the learning gains over traditional lecture in Physics
- Increased student understanding and engagement
 - Physics, Biology, Math, and Computer Science
- In CS (both introductory and advanced) courses
 - Reduced failure rates
 - Improved retention
 - Increased final exam performance

Leo Porter and Beth Simon. “Retaining nearly one-third more majors with a trio of instructional best practices in CS1”. In: *Proceeding of the 44th ACM technical symposium on Computer science education*. 2013, pp. 165–170.

Peer+ Tool in Runestone

Support for Peer Instruction questions

- Students answer in an ebook
- Can discuss question via chat

Peer Instruction Question

Please Give an explanation for your answer

Then discuss your answer with your group members

What programming language does this site help you to learn?

- A. Python
 B. Java
 C. C
 D. ML

Thanks, your answer is recorded.

Activity: 2.1.1 Multiple Choice (question1_1)

Your answer B

peer2 answered C

Please discuss the answers with your group members

peer2: Hello World! C is the correct answer!!

Not so fast peer2, in the immortal words of the bard, 2 B or ! 2 B

peer2: OK, but maybe we should consider Python?

Please provide a confidential rating of peer's explanation

Poor Good Excellent

Peer+ Tool in Runestone

Support for Instructor

- Buttons for process
- The number of answers updates live
- Show the graph of the two votes

Peer Instruction Dashboard

Group Size ▾

Stop Vote 1

Enable Discussion

Start Vote 2

Stop Vote 2

Next Question

Start Over

Q-1: What is returned from $3 \% 4$?

A. 0

B. 1

C. 2

D. 3

E. 4

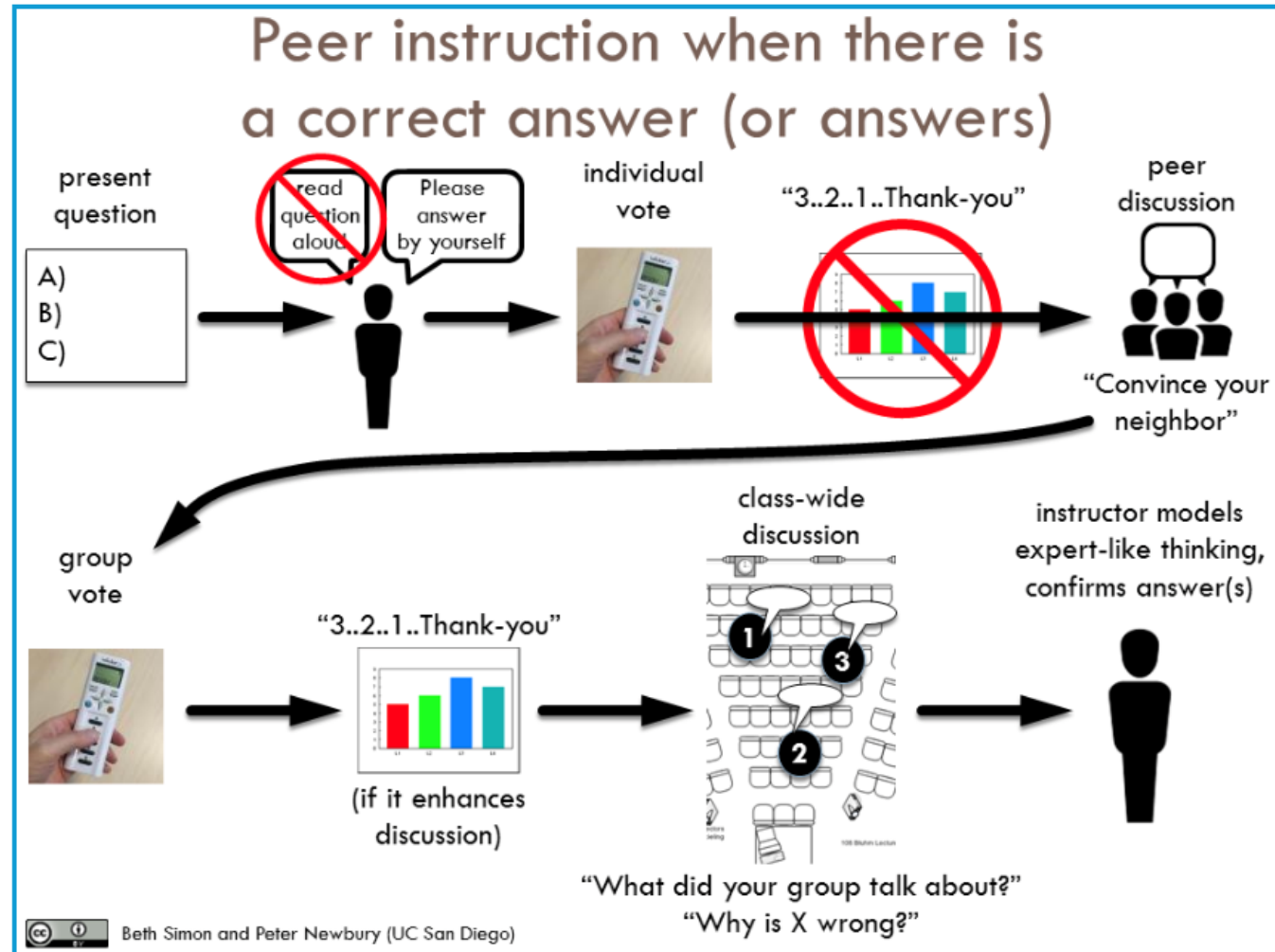
Check Me

Activity: 1 Multiple Choice (pi-basics-modulo-v3)

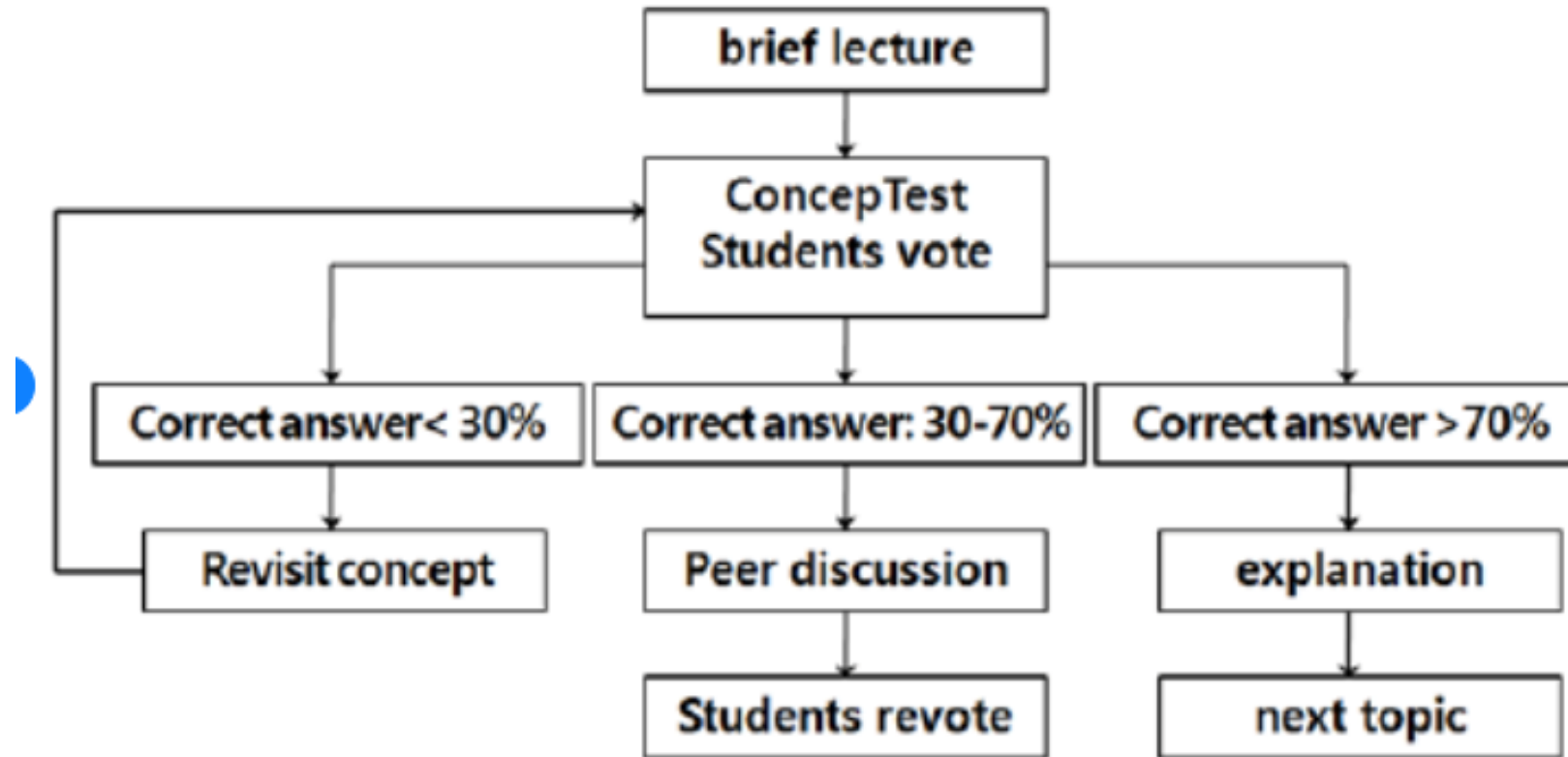
Vote 1 Answers: 0

Hide/Show Graph

Peer Instruction Process



Hard Questions are Best



Finding Peer Instruction Questions

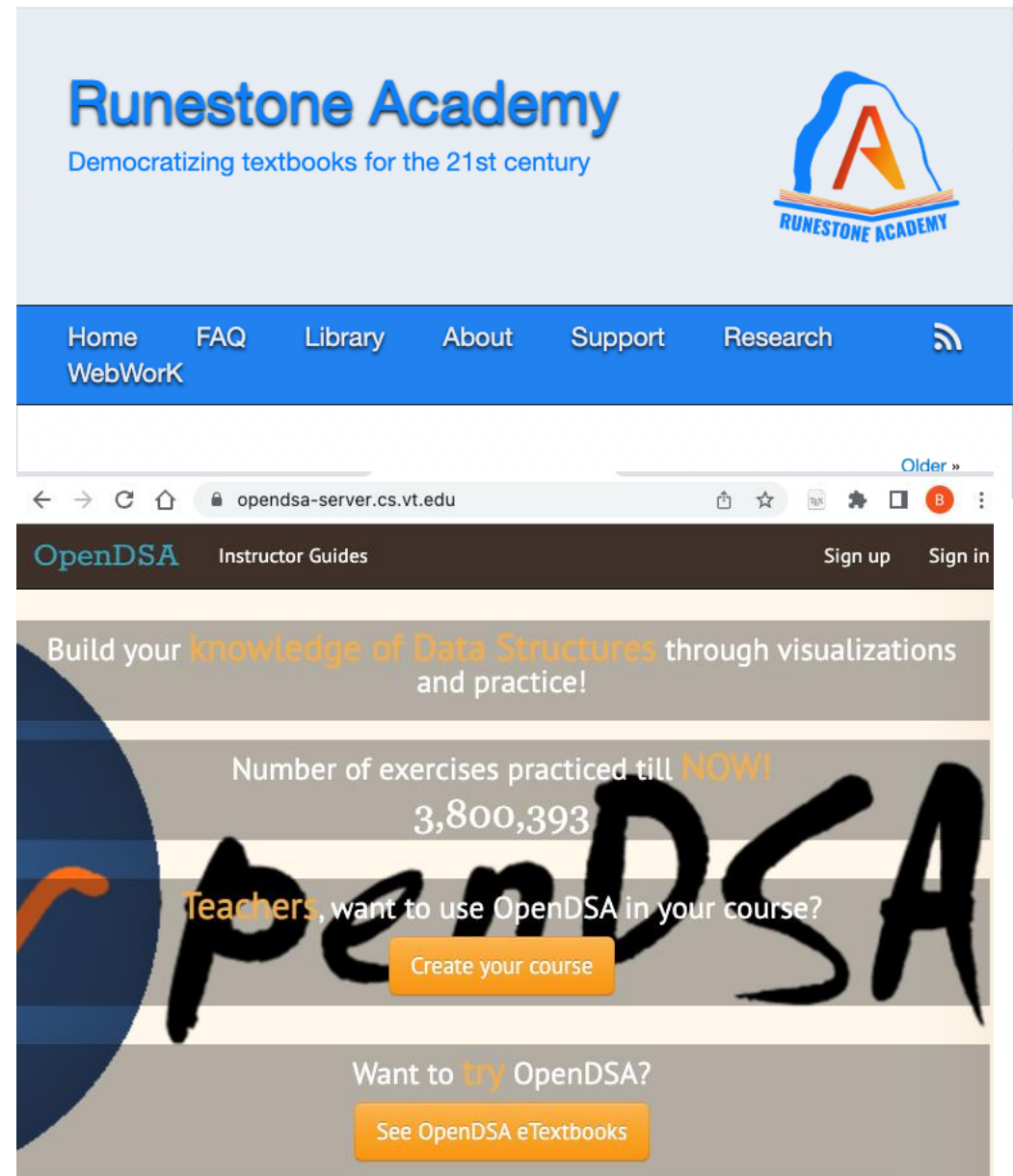
We added questions from several public question banks to Runestone

- CS Peer Instruction questions: <http://peerinstruction4cs.com/>
 - CS1 in Python
 - Dan Zingaro (dz-)
 - Cynthia Taylor (ctp-)
- PeerWise Question Bank
 - peerwiseqb
- Canterbury Question Bank
 - Canterburyqb

Will be adding questions in Java and C++ this summer

Summary

- Active Learning can improve student learning and engagement
 - Interactive ebooks
 - Parsons problems
 - Peer Instruction
- Ebooks can reduce instructor's workload
 - Automatic grading
 - Lots of practice problems



The screenshot displays the Runestone Academy website. At the top, the logo for Runestone Academy is visible, featuring a stylized 'A' inside a blue mountain shape with the text 'RUNESTONE ACADEMY' below it. The tagline 'Democratizing textbooks for the 21st century' is positioned to the left of the logo. A navigation bar includes links for Home, FAQ, Library, About, Support, and Research, along with a WebWorkK link and a RSS icon. Below the navigation bar, a search bar is present. The main content area features a dark header for 'OpenDSA' with 'Instructor Guides' and 'Sign up / Sign in' options. The central message reads: 'Build your knowledge of Data Structures through visualizations and practice!'. A large graphic shows 'Number of exercises practiced till NOW!' with the number '3,800,393'. Below this, it asks 'Teachers, want to use OpenDSA in your course?' and provides a 'Create your course' button. At the bottom, it asks 'Want to try OpenDSA?' and provides a 'See OpenDSA eTextbooks' button.