UNIVERSITY OF CALIFORNIA, BERKELEY
Department of Electrical Engineering and Computer Sciences
Computer Science Division

CS10 Fall 2026 **TA: Nahee J.**



SOLUTIONS

Discussion 9: Midterm Practice

Instructions:

- We will be doing a QR attendance check sometime in the middle of the section. If you have arrived late or must leave early, simply take a selfie of yourself with the screen and make a private post on Edstem. We will manually mark you as present.
- For the worksheet, you can either explain the process in words, show a screenshot, or draw the block/process.

Group Activity / Question of the Day

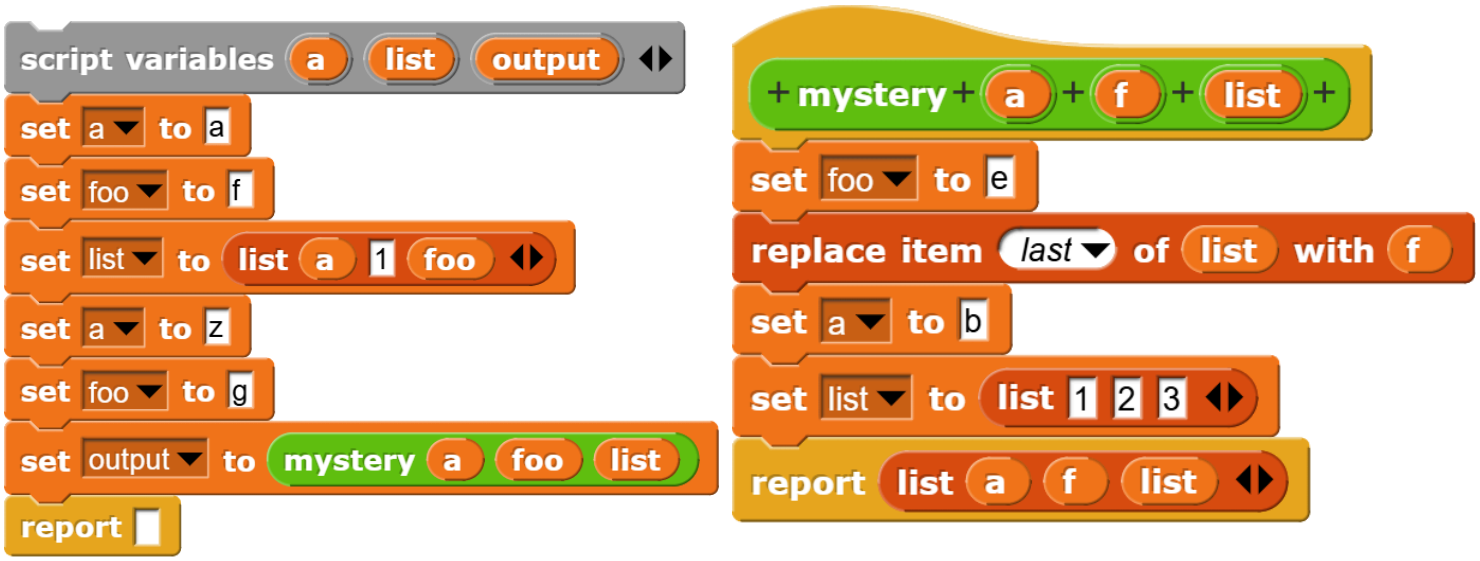
- Do you have a favorite word? And why? Where did you first learn it?

Required (Pages 2 - 8):

Section I - Scope

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1. Determine what will be reported if the following variable was in the "report" block. You will need to trace the script to determine the outputs.



a. 

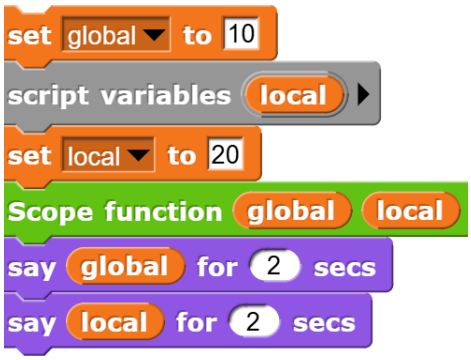
b. 

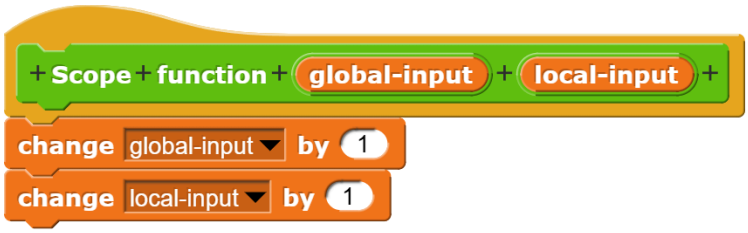
c. 

d. 

a = z
foo = e
list= [a, 1, g]
output = [b, g, [1, 2, 3]]

1. Determine what the 'say' blocks should say for each script
    a. Script 1

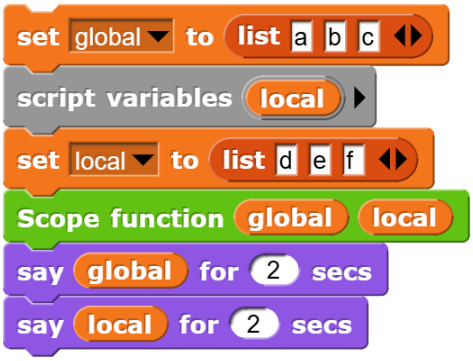


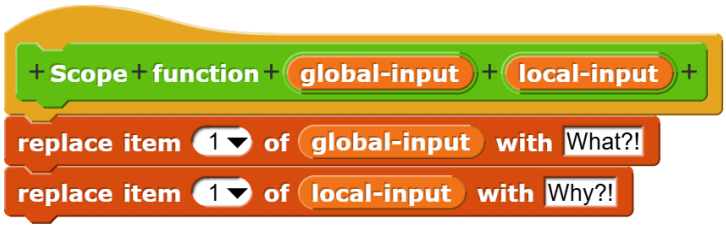


Global says 10
Local says 20

When we input the value of global and local into our scope function, because both variables store numbers – we only copy over the values. So the connection between global-input and global, and local-input and local is broken – since we cannot mutate numbers

    b. Script 2





Global says: [What?!, b, c]
Local says: [Why?!, e, f]

Since global and local are both lists, global-input and local-input can modify global and local directly (they point to the same values)

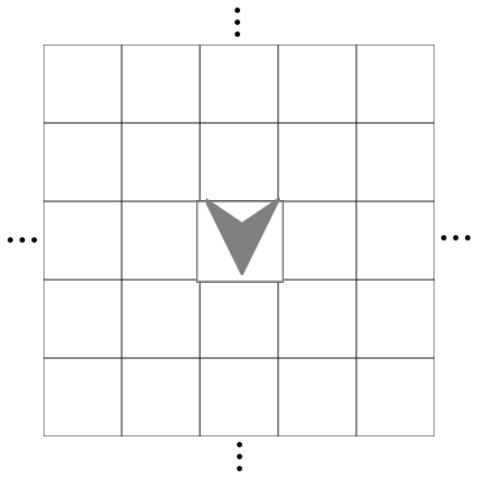
Section II – Iteration + Randomness

Here are helper blocks for controlling a robot (shaped like an arrowhead) on a grid world (infinite in both X and Y dimensions), looking down on it.

2. The robot moves N squares forward in the direction it's facing.



3. The robot turns some number of degrees clockwise (right), in-place, about its center. (remaining in the same square).

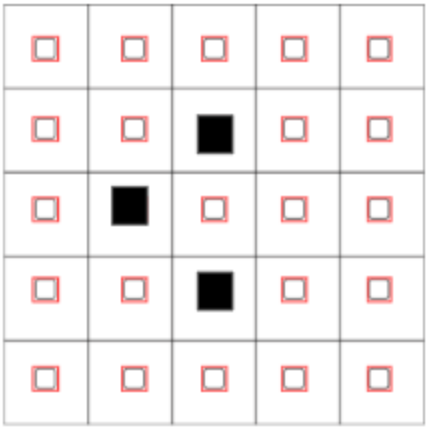


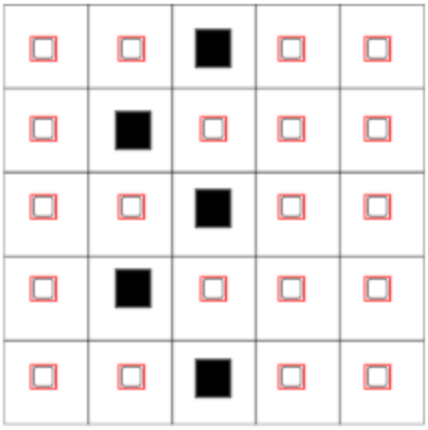
4. The robot starts in the center square, facing right (direction = 90).



A. Fill out the grid for all end squares of Walk(1)

B. Fill out the grid for all end squares of Walk(2)

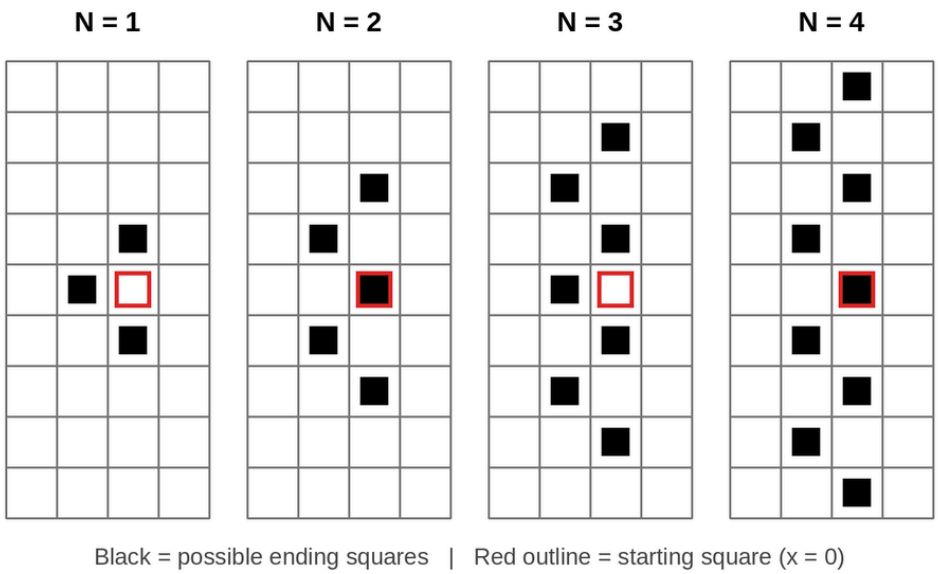




Tracing: the robot starts facing right (direction = 90). Each pass of the loop turns it by direction + direction × (0, 1, or 2), so its new direction is 2×, 3×, or 4× its old direction (mod 360). From 90 that is 180 (down), 270 (left), or 0 (up). From 270 it is 180, 90 (right), or 0. From 180 it is 0 or 180. From 0 it stays 0 forever. So Walk(1) can end 1 square up, down, or left of the start, and Walk(2) can end on the start square, 2 up, 2 down, or 1 left and 1 up/down.

C. Is there a pattern? If so, can you draw out the pattern as N gets larger?

Yes. The possible ending squares form a checkerboard zig-zag that stays in just two columns (x = 0 and x = -1) and gets taller as N grows. For Walk(N): in the x = 0 column the robot can end at y = N, N-2, …, -N, and in the x = -1 column at y = N-1, N-3, …, -(N-1).



D. If the center is x=0. What is the maximum
x value to the right for any given N?

The max is always x = 0. The robot can step left to x = -1 and back, but it never gets to the right of its starting column.

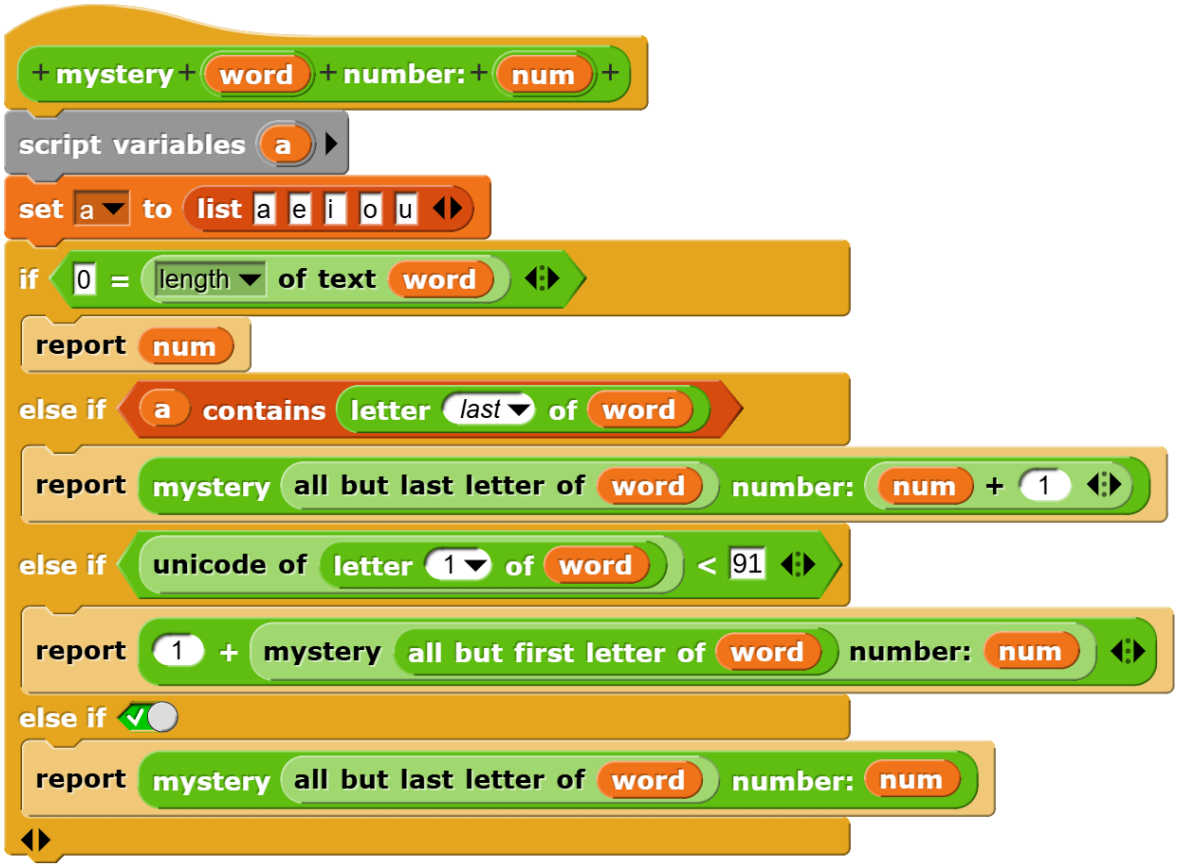
Section III – Recursive Tracing

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1. Trace the function.
    a. Determine what the function is doing in your own words.
    It counts the vowels in word plus any capital letters at the very start of word.
    Each pass: if the last letter is a vowel, count it and remove it; otherwise, if the first letter is a capital (unicode below 91), count it and remove it; otherwise just throw away the last letter.
    So a capital letter in the middle or at the end of the word is never counted.

    b. Determine what the function outputs if the following is inputted:
    Returns 5: it counts the 4 vowels (i, o, i, a) plus the capital V.



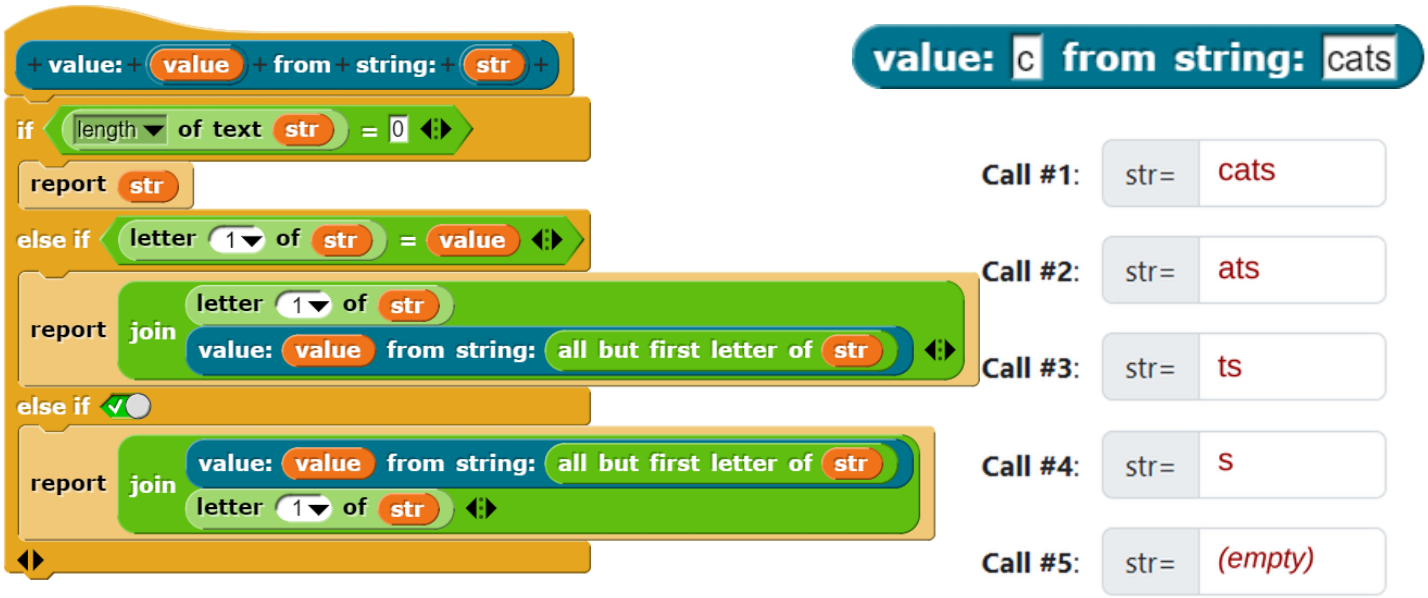


c. What value for word would cause the function to output 3? There is more than one correct answer.

aanvi
marius
nahee
EThan
Jacob
Bella
Any word with exactly 3 vowels plus leading capitals works. Capitals that are not at the front are not counted, so eThan and JaclyN would only output 2.

2. Your job is to understand and trace the function each time it is called or enters a new frame. Trace the function, and find the input value for str for that frame. By trace, we mean, figure out what the inputs are (what str is set to) for each frame.

You DO NOT need to trace the value for value. You will be tracing the following call:



3. What will the final output be for: value: c from string: cats
   csta
4. What would the final output be for: value: o from string: world
   odlrw

How it works: letters equal to value stay at the front; every other letter is moved to the back in reverse order (cats gives c + sta, and world gives o + dlrw).

Section IV – Algorithmic Complexity

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1. For each of the following scenarios, determine what the worst-case runtime would be:
   a. Count how many students raised their hands. You scan a line of N students once and tally hands up.
      linear
   b. You have a list of N movies to watch this month. You want to decide which ones to include in your marathon, so you try every possible combination of movies (watch some, skip others) to see which set gives the highest total

enjoyment.

Exponential

c. You have N students and N locker numbers, all on sticky notes and shuffled. You compare every pair of notes to see if two students have the same locker.

   quadratic

d. Guess a secret number with higher/lower feedback on a fixed range. The number is somewhere from 1 to a known large maximum. You're told "higher" or "lower" after each guess; you must guarantee finding it.

   log

e. You're a security guard walking down a hallway. You scan a badge once to unlock every door in the building.

   constant

f. You are going to a party where you need to bring three different dishes. There are N different dishes you can pick up. You find every combination of three dishes and then pick one combination of three dishes you like the best.

   cubic

g. You want to check a list of restaurants to see if each is vegetarian. Instead of going to each restaurant's website, you access a site that allows you to check at one time if all the restaurants you're interested in offer a vegetarian option.

   constant

h. You have a list of N movies, sorted by how much money they made (lowest

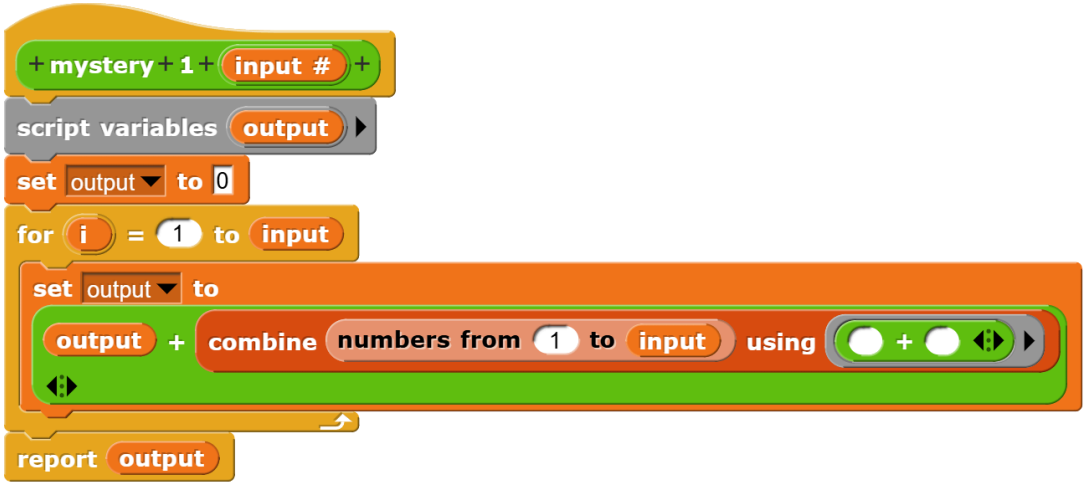
to highest). You want to find the first movie in the list that made over $100 million. Each time you check a movie, you jump to the middle of the remaining part of the list.

log

2. For each function, determine the worst-case runtime.

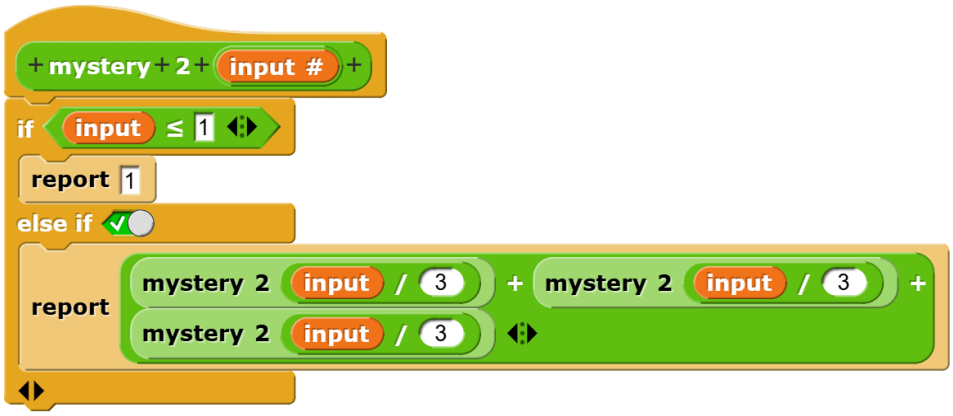
   a. Mystery 1

      Quadratic: the for loop runs N times, and each pass builds a list of N numbers and adds them up (about N steps), so $N \times N = N^2$.



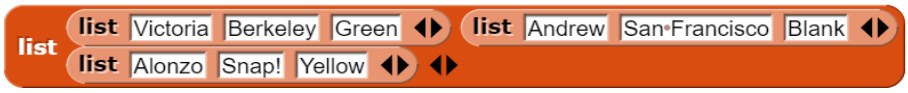
   b. Mystery 2

      Linear: each call makes 3 recursive calls on input / 3, so the total number of calls grows in proportion to N ($T(N) = 3 \cdot T(N/3) + 1$).



Section V – HOFs

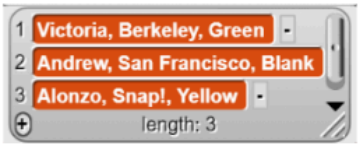
1. Consider the following list



3	A	B	C
1	Victoria	Berkeley	Green
2	Andrew	San Francisc	Blank
3	Alonzo	Snap!	Yellow

The objective is to report the following flattened list using 3 functions/operations





Choose the corresponding functions that will allow us to do so







2. Using the same input list, we now want to output the list below.Circle the options below that will allow us to return the desired output (may be more than one)

3	A	B	C	D
1	Victoria	Berkeley	Green	CS10
2	Andrew	San Francisc	Blank	CS10
3	Alonzo	Snap!	Yellow	CS10




map append list join CS10 over data
map reverse of CS10 in front of reverse of over data
map
list item 1 of item 2 of item 3 of join CS10
over data
combine data using map list join CS10 over data