UC Berkeley's CS10 Fall 2018 Final Exam: Prof. Dan Garcia, Instructor

Your Name (first last)	*SID*	*Lab TA's Name*

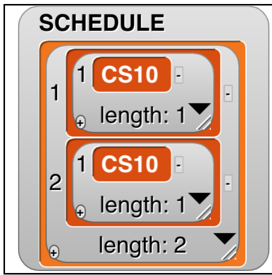
← *Name of person on left (or aisle)* *Name of person on right (or aisle)* →

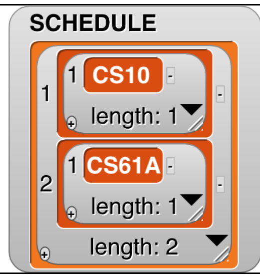
Fill in the correct circles & squares completely…like this: ● (select ONE) ■ (select ALL that apply)

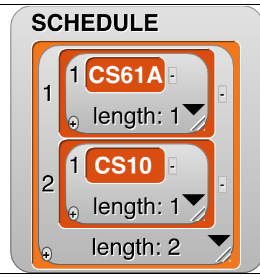
What's that Smell? Oh, it's Potpourri! (2 pts each for 1-6, low score dropped)

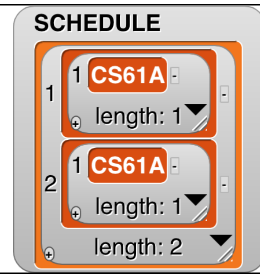
Question 1: What is **SCHEDULE** after

? (select ONE)

○ 

○ 

○ 

○ 

○ None of these

Question 2: What does

report? (select ONE)

○ It's an error since you can only have + or × or **`join`** with two total holes in the **`combine`**.
○ It doesn't report anything, it mutates the values in the list.
○ It doesn't report anything, it causes an infinite loop.
○ It depends on the implementation of **`combine`**, since it's not an associative *and* commutative function.
○ None of these

Question 3: Which of the following was NOT from the *Human-Computer Interaction* lecture? (select ONE)
○ The design of ballots can affect and has affected the outcomes of elections.
○ The classic design cycle is (1) gather specifications from client (2) code it up (3) deliver it to the client. Done!
○ We study interfaces because ~50% of a program's source code is typically dedicated to the user interface.
○ The Mouse was invented in 1963, well before Apple showed it to the world connected to an early Macintosh.
○ None of these

Question 4: Which of the following was NOT from the *Artificial Intelligence (AI)* lecture? (select ONE)
○ AI systems can now *transfer the "style"* of a painting to another image.
○ The primary goal of reinforcement learning today is to make agents that *think rationally*.
○ China has developed a "virtual anchor" to deliver the news that is *almost indistinguishable from a real person*.
○ Neural networks would determine the probability that a photo has a cat in it, *rather than* a simple yes/no.
○ None of these

Question 5: Which of the following was NOT from the *Algorithmic Bias* lecture? (select ONE)
○ Google Image searches for "Grandmother" showed that almost all the results were of older white women.
○ Facial recognition algorithms were 99% accurate for white male faces, far less for darker skinned women.
○ Google translate was exhibiting gender bias: "__ is a doctor" was "he", but "__ is a nurse" was "she".
○ COMPAS was software that was written to try to address racial bias in sentencing by human judges.
○ None of these

Question 6: What was one memorable moment from the alumni panel? (select ONE)
○ One of the panelists had a bloody nose and had to leave the stage.
○ One of the panelists came quite late (more than half-way into the conversation)
○ One of the panelists had an emergency phone call during the panel and had to leave the room.
○ One of the panelists gave out swag to every CS10 student.
○ None of these

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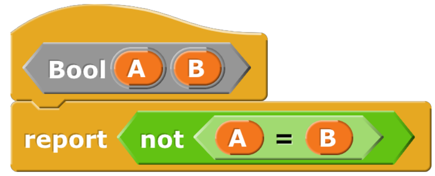
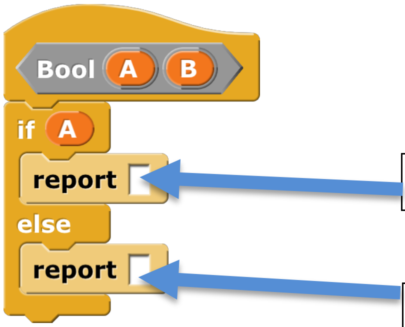
(The **Bool** block on the right is used for Questions 7 & 8; 3 pts each)



Question 7: Fill in the blanks so the predicate is the same as the original **Bool** block. (select ONE from each)



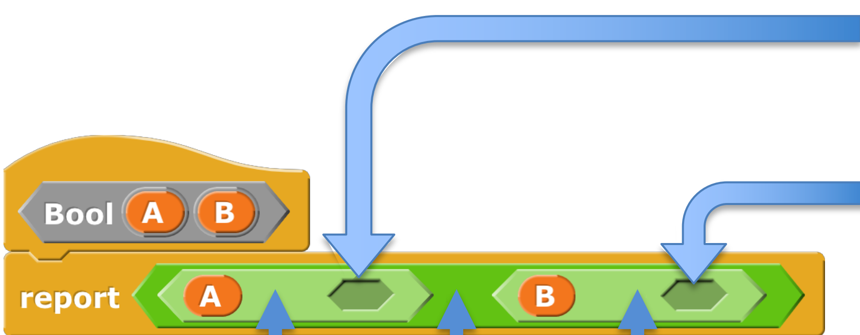
○	○	○	○	○	○
true	false	A	not A	B	not B

○	○	○	○	○	○
true	false	A	not A	B	not B

Question 8: Fill in the blanks so the predicate is the same as the original **Bool** block. (select ONE from each)

○	○	○	○	○	○
true	false	A	not A	B	not B

○	○	○	○	○	○
true	false	A	not A	B	not B

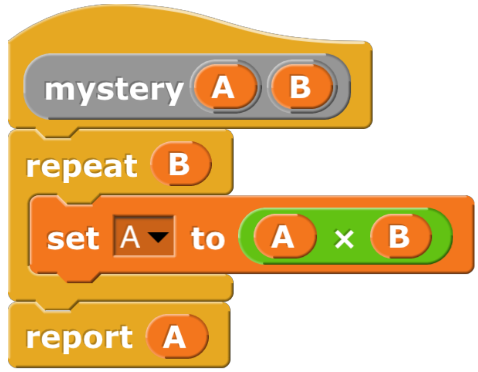


○	○
and	or

○	○
and	or

○	○
and	or

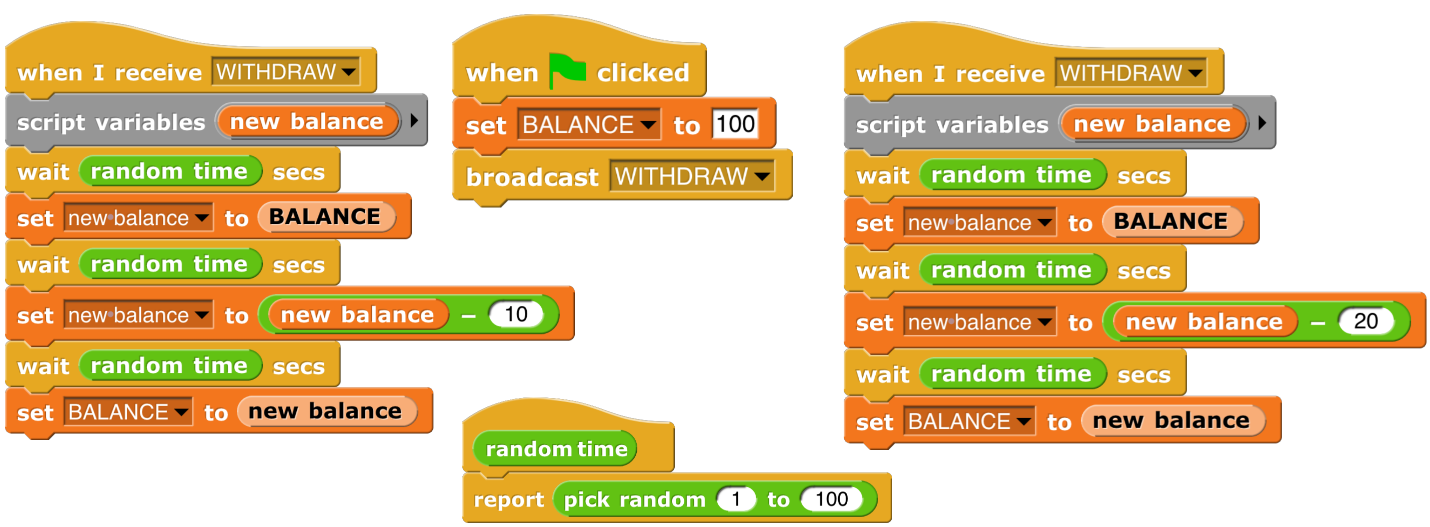
Question 9: What does **`mystery`** (below) report, if B is a counting number (i.e., 1, 2, …)? (select ONE, 3 pts)



○	○	○	○	○	○	○	○	○	○	○
A×B	A^B	B^A	B^2	A×B^2	A×B^B	A×B^A	A×A^B	Product of all the numbers from A to B	Error	Infinite Loop

Question 10: What are possible values of **`BALANCE`** when the program is done? (select ALL that apply, 3 pts)

☐	☐	☐	☐	☐	☐
60	70	80	90	100	110



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Question 11: *Will the person with the highest-numbered SID please stand up?* (9 pts)

Here are 3 algorithms to find the student with the highest-numbered Student ID (SID)…note, SIDs are unique. For all problems, assume the number of students is really big. (How big?) Really big. Also, “clock time” is the actual elapsed time if you used a clock or stopwatch to time the running of the algorithm.

Algorithm I – “Meet Everyone” algorithm

1. Everyone walks around the room and compare SIDs with everyone else. Whenever two students meet, the one whose SID is smaller takes a coin labeled “not the largest” from a pile and pockets it.
2. After everyone has met everyone else and compared SIDs, anyone with a coin in their pocket sits.
3. The person remaining standing has the largest SID.

Algorithm II – “Down the Line” algorithm

1. Everyone lines up, and the first person is designated as the “largest-so-far”.
2. The “largest-so-far” person goes down the line, comparing their SID to that of each new person, 1-on-1.
3. Whenever a new person’s SID is larger than the “largest-so-far”, that new person *replaces* the “largest-so-far” person and continues going down the line, doing step 2.
4. The last person to be “largest-so-far” has the largest SID.

Algorithm III – “Tournament” algorithm

1. Everyone stands up
2. All standing people pair up and compares SIDs. (If there’s an odd number of people, the “odd person out” just stands around idle for that round.)
3. Whomever has a smaller SID sits down.
4. Step 2-3 continues until there is one person standing; that person has the largest SID.

a) In the WORST case, what’s the number of *comparisons* (NOT running time)? (select ONE per row)

Algorithm	Constant	Logarithmic	Linear	Quadratic	Cubic	Exponential
Meet Everyone	○	○	○	○	○	○
Down the Line	○	○	○	○	○	○
Tournament	○	○	○	○	○	○

b) If all SID comparisons must occur in a SINGLE (small) ROOM, and only 2 people could fit in that room, how much clock time (NOT running time) would each algorithm take in the BEST case? (select ONE per row)

Algorithm	Constant	Logarithmic	Linear	Quadratic	Cubic	Exponential
Meet Everyone	○	○	○	○	○	○
Down the Line	○	○	○	○	○	○
Tournament	○	○	○	○	○	○

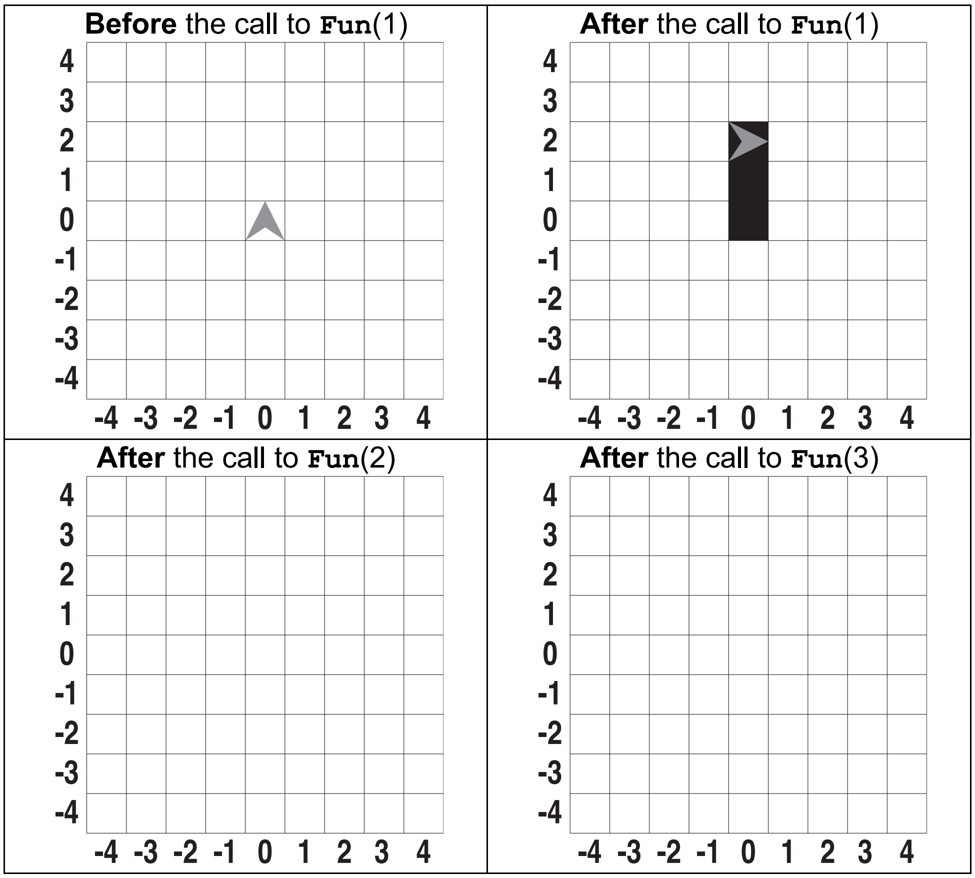
c) If the SID comparisons between different pairs of people could happen at the same time, how much clock time (NOT running time) would each algorithm take in the BEST case? (select ONE per row)

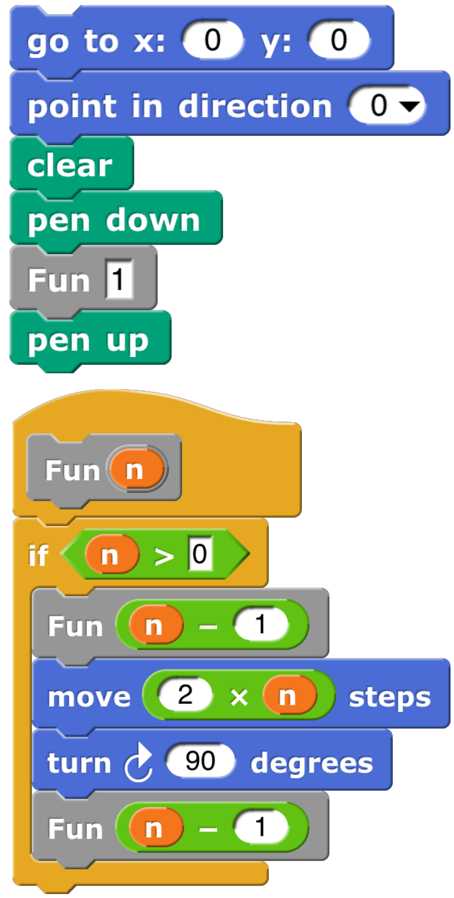
Algorithm	Constant	Logarithmic	Linear	Quadratic	Cubic	Exponential
Meet Everyone	○	○	○	○	○	○
Down the Line	○	○	○	○	○	○
Tournament	○	○	○	○	○	○

Question 12: *We put the Fun in Functional Programming…* (15 = 4+4+4+3 pts)

Consider the following code below on the right. We're now to going to zoom in on pixels affected by calls to `Fun`; the stage is always cleared before the calls below, the sprite always starts in the center facing up, and the pen is in the *center* of the sprite.

a) Your job is to shade in (completely!) *all* the pixels that will be colored in after calls to `Fun` with n set to **2** and **3**; draw sprite at the end in some way that helps you (for this question, we'll only look at the pixels when we're grading). *Clarification: if the sprite were at (0,0) and moved 2 steps up, it would be at (0,2) and all pixels along the line from (0,0) through (0,2) would be shaded; 3 pixels in total.*





b) What direction is the sprite facing at the end of the call to **Fun**(3)? (select ONE)

○ ←
○ ↑
○ →
○ ↓

c) What direction is the sprite facing at the end of the call to **Fun**(100)? (select ONE)

○ ←
○ ↑
○ →
○ ↓

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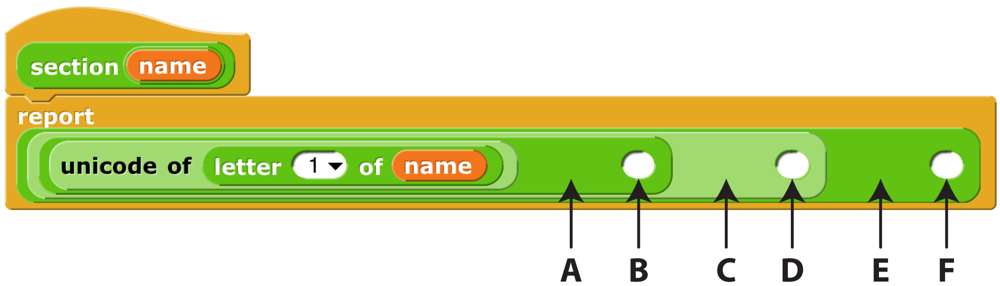
Question 13: *Trust me on the sunscreen…* (6 pts)

There are three seating areas at graduation, and they assign people based on the first letter of their last name as follows: "A"s in section 1, "B"s in 2, "C"s in 3, "D"s in 1, etc.

Section 1	Section 2	Section 3
Adams Diaz etc.	Banderas Estrada etc.	Chavez Fox etc.

Complete the block that finds the section based on the last name. Hint: The unicode of "A" is 65.
(select ONE per row)



	+	–	×	÷	mod	and	or	0	1	2	3	4	63	64	65	66	67
A	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
B	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
C	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
D	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
E	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
F	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Question 14: *Mommy, he was counting in Binary on his fingers and he gave me the `0b00100…`* (15 pts)

Write a block converting Binary to decimal: 

$1*2^2 + 1*2^1 + 0*2^0=4+2=6$

Here is a helper block to compute a base to a power, e.g., 2^4 = 16: 

Here's a reminder how the map with two lists works:

A couple of notes. First, your solution should use each of these blocks *exactly once*, so there should be one circle filled in for every column and row (but, multiple blanks are ok). Also, the `numbers-from( )to( )` block works if the first argument is smaller or bigger than the second argument. So `numbers-from(3)to(1)` would return a list with the first (topmost) element 3, the second element 2, and the last (bottommost) element 1.

Put these blocks below… / …into these slots	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
map (b) over (c)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
# map (d) over (e) (f)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
combine with (g) items of (h)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
numbers from (i) to (j)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
(k) × (l)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
(m) + (n)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
(2) ^ (o)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
word ➔ list binary	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
length of binary − 1	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
0	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
…blank…	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

As a sanity-check, write your solution out below (so you don't get points off for bubbling things wrong!)

___

___

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Question 15: *Berkeley `python`'s flying circus [this is a 2-part question]…* (18 pts = 9 * 2pts)

We recreated an interpreter script. For each, indicate what the right answer should be.

```
>>> "".join(["berkeley"[int(i)] for i in "31415"])
```

○"bbberrrrkeeeee" ○"bbrrrkkkk" ○"rbkbe" ○"keeel" ○ Error ○ None of these

---

```
def swap_values(A,B):
     A = B
     B = A

def swap_elts12(w):
     w[1] = w[2]
     w[2] = w[1]
     return w

>>> you = 20 ## your age, that is
>>> dan = 50 ## dan's age, that is
>>> swap_values(you, dan)
>>> [you, dan]
```

○[20,50] ○[50,20] ○[20,20] ○[50,50] ○ Error ○ None of these

```
>>> swap_elts12([5,6,7,8])
```

○[5,7,6,8] ○[6,5,7,8] ○[5,7,7,8] ○[5,6,6,8] ○ Error ○ None of these

```
>>> swap_elts12("bear")
```

○"baer" ○"ebar" ○"baar" ○"beer" ○ Error ○ None of these

```
def mystery(arg):
     D = {}
     for a in arg:
          for b in a:
               if a in D:
                    D[a] += 1
               else:
                    D[a] = 1
     return D
```

```
>>> D = mystery(["cal", "california", "a"])
>>> D["a"]
```

○0 ○1 ○2 ○3 ○4 ○5 ○6 ○7 ○8 ○9 ○10 ○ Error ○ None of these

```
>>> E = mystery("california")
>>> E["a"]
```

○0 ○1 ○2 ○3 ○4 ○5 ○6 ○7 ○8 ○9 ○10 ○ Error ○ None of these

Question 15: *Berkeley `python`'s flying circus, continued…* (18 pts = 9 * 2pts)

```
def stutter(word):
    ### cal → ccal
    return word[0]+word
```

```
def reverse(word):
    ### cal → lac
    return word[::-1]
```

```
def duplicate(word):
    ### cal → calcal
    return word+word
```

```
def compose(f,g):
    ### Same as Snap's compose block
    return lambda x: f(g(x))
```

```
### reduce is just like Snap!'s combine: reverse(stutter(duplicate(word)))
frankenstein = reduce(compose, [reverse, stutter, duplicate])

>>> frankenstein("cal")
"laclacc" ### same as Snap!

L = […some combo of duplicate, stutter, reverse (possibly 0 or many of each)…]
>>> frankenstein_bride = reduce(compose, L)
```

`>>> duplicate(duplicate(2))`

○`"2222"` ○`"44"` ○`"8"` ○`"6"` ○`2222` ○`44` ○8 ○6 ○ Error ○ None of these

`>>> duplicate("duplicate(2)")`

○`"2222"` ○`"44"` ○`"8"` ○`"6"` ○`2222` ○`44` ○8 ○6 ○ Error ○ None of these

What are possible return values of `frankenstein_bride("cal")`? (select ALL that apply)

☐`"call"` ☐`"caal"` ☐`"ccallcal"` ☐`"calac"` ☐`"lacal"` ☐`"acl"` ☐ None of these

You're done, congrats!!