Please read all instructions carefully.

This exam consists of two parts. The first part should be completed without the use of Scratch and your answers should be written on the paper titled "CS39n - Midterm - PART 1". Once you complete Part 1, please write your name on the last page (of part 1) and turn it in before continuing on to Part 2. The second part of the exam will be done on the computer. Please submit part 2 according to the directions in the attached document. The exam and all files are available from the bSpace assignments tab.

This exam is out of 100 points.

<table>
<thead>
<tr>
<th>Programming Part without Computers:</th>
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<tbody>
<tr>
<td>(7 pts) Prob 1</td>
<td></td>
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<tr>
<td>(7 pts) Prob 2</td>
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<td>(6 pts) Prob 3</td>
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<tr>
<td>(8 pts) Prob 4</td>
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<tr>
<th>Programming Part with Computers:</th>
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<tr>
<td>(16 pts) Prob 5</td>
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<td>(8 pts) Prob 6</td>
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<tr>
<th>Writing Section:</th>
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<tr>
<td>(16 pts) Prob 7</td>
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<td>(16 pts) Prob 8</td>
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Total:
Part Without computers

1. This semester, you have encountered two blocks for manipulating boolean variables: or and and. These two blocks have the truth table as shown. In computer science, there is another operator that we often use, called XOR, also known as exclusive or. This operator is described in the rightmost truth table. In other words, it is an or that does not return true if they are both true.

Write XOR two different ways. You may write TRUE or FALSE in the blanks. You may assume that $a$ and $b$ are both booleans and may go in the blanks directly if appropriate. You may find the Boolean function not useful:

a) using if/else but without using and/or

b) using and/or but without using if/else by filling out ONLY the report blank. *Hint: you may nest blocks together.*
2. Definition: **Pig Latin** : made-up language formed from English by transferring the initial consonant or consonant cluster of each word to the end of the word and adding “ay” at the end): SCRATCH would become ATCHSCRAY. Here is the code for **piglatin** with helpers **vowel?**, **first** and **butfirst** (the latter two you’ve seen before):

```
# Pig Latin code

# Function to check if the first letter is a vowel
vowel? letter = letter in 'aeiouAEIOU

word

# Function to extract the first vowel
first word

# Function to check if the word is the first of the sentence
first

# Function to check if the word is the second of the sentence
butfirst

piglatin word

if vowel? first word
    result = result + 'ay'
else
    result = result + word[1:]

report result
```

a) What is piglatin america? 

b) Will piglatin always return successfully? If so, provide a one-sentence argument why it will. If not, what does it do? (circle one: return incorrect answer, crash, infinite-loop), and provide an input word that causes it to do what you circled.

c) Your partner suggests you write **un-piglatin** to take a piglatin word and return the original word that generated it. E.g., un-piglatin ATCHSCRAY should return scratch. In one sentence, what's wrong with this idea?
3. Given `fun` defined below:

![Block Editor](image)

a), how many a's are reported when called with each n value below? Write the number of “a”s in the boxes below.

<table>
<thead>
<tr>
<th>fun 0</th>
<th>fun 1</th>
<th>fun 2</th>
<th>fun 3</th>
<th>fun 4</th>
<th>fun 5</th>
</tr>
</thead>
</table>

b) What other function has a similar pattern?
4. Draw the fractals created by this block with size = 240 and level = 1, level = 2 and level = 3. The arrow indicates the initial direction and position of your sprite.
Name:

CS39n Login: cs39n-____

(you can use the rest of this page as Scratch paper)
Part With Computers:

Instructions:

First, go to the bSpace final assignment, and download the final.sb file. This file has multiple sprite, one sprite for each question in this part of the exam. Do each exercise in the sprite indicated. Please save your scratch file as "FIRSTNAME_LASTNAME.sb". For example, your TA Colleen would save their file as "COLLEEN_LEWIS.sb". Submit this under the bSpace 'final' assignment with the written portion (below).

Then, for each sprite and any blocks you modify or create, paste their screenshots together, and print out a physical copy. You will turn these in as well.

5. You're told that the * block will cause the computer to crash if you use it. "No Problem," you say, "I'll just build my own ‘x product y’ block using BYOB!" Assume x is always a non-negative integer (i.e., 0,1,2,3,...), but y can be any real number: (1.283, -3.14, ...). You realize there are two ways to do this, one using recursion and one without.

   a) Write the block ‘x nonrecursive-product y’ without recursion. Hint: 3*1.7 = 1.7 + 1.7 + 1.7

   b) Write the block ‘x recursive-product y’ with recursion. Hint: 3*1.7 = 1.7 + (2 * 1.7)
6. Write a program to generate the fractal shown below. The images below show the fractal for level=0 level=1, level=2, and level=3. The sprite should turn 60 degrees to generate the initial bend, and the two line segments in the base case are of length 120. Each “bent L” is 1/2 of the length of the one in the level before it. The two drawings of the next level are separated 90 degrees apart.

Instructions: Please type the following into a text editor and submit it under bSpace as well. Turn in a printed copy.

7. Definition: democracy : the practice or principles of social equality.
   Computers have served as both a democratizing (giving power to the people) and anti-democratizing
(concentrating power in the hands of the rich/powerful) influence. Describe the two most significant democratizing uses. Then, describe the two most significant anti-democratizing influences and suggest politically & socially feasible (i.e., things that could actually be implemented in our existing society) ways to counteract it. Here is one example each – remember, you’re asked for two examples)

**Democratizing:** Blogs/cameraphones/youtube have completely transformed information creation; stripping power from mainstream media sources and allowing anyone with something to say an easy, and often free outlet to share opinions, info, etc.

**Anti-democratizing:** The loss of mom-n-pop stores to massive internet presences like Amazon, who can demand deep discounts from publishers and don’t have traditional overhead costs. Solutions that might work: Actively pursue anti-monopoly laws to limit growth. Find a way to work with Amazon (a feature they later added called “Marketplace”) to incorporate listings from smaller stores.

8. **Proposal:** Require a subdermal (underneath the skin) implant of a GPS (global positioning system) chip in every human. This GPS chip would have a unique identifier and be able to be queried externally to request its position and identifier number. Therefore, it could help us answer two questions:

- *Who* is this person? [the chip would return its identifier number]
- *Where* is a particular person? [the network would return the GPS coordinates of the person in question]

Write the equivalent of an "environmental impact report" in which you discuss all the aspects of this proposal: benefits, downfalls, possible abuses, etc. Strive for breadth and try to cover as many angles as you can (max 4). To keep this organized, limit every “angle” to one sentence, and preceed it by the aspect category. E.g.,

- downfall: implanting it would probably hurt
- benefit: people who like pain would probably enjoy the implantation
- etc.

9. **In the future, we may be able to connect a human brain to a computer.** However assume we can only go in one direction. That is, we can either send **output from a computer** to a human brain (computer→human, so the computer could drive your senses or muscles...obviating the need for a display or speakers) or **input data to a computer** from a human brain (human→computer, so you could think something and the computer would know it...obviating the need for a keyboard or mouse). Argue which you’d choose and why, with 4 one-sentence examples of the most amazing applications one could realize with the option you chose.