This exam is closed notes.

You have 50 minutes to complete the 5 questions on this exam.

Please write your answers clearly.

Good luck!
**Question 1: Truth or Consequences**
Consider whether each of the following statements is True or False. Circle the correct answer.

- True   False   The purpose of a CAPTCHA is to distinguish humans from computers.
- True   False   Computers can visually identify objects better than humans can.
- True   False   A recipe is an algorithm.
- True   False   Scratch is an algorithm.
- True   False   A flowchart can be used to express an algorithm.
- True   False   A program may return different outputs given different inputs.
- True   False   Different programs can be constructed from the same set of blocks or instructions.
- True   False   In Scratch, the Stage can have scripts associated with it.
- True   False   In Scratch, each script runs to completion before the next script is started.
- True   False   In Scratch, multiple scripts from the same Sprite may run concurrently.
- True   False   In Scratch, multiple scripts from different Sprites may run concurrently.
- True   False   Initializing variables is important when a program ends.
- True   False   A variable can be thought of as a container in memory holding different values over time.
- True   False   In Scratch, a variable can contain only strings (that is, words, letters, or characters).
- True   False   If a race condition exists, two Sprites asking the same question can obtain different answers.
- True   False   The best way for one Sprite to tell another Sprite to do something is to broadcast a message.
- True   False   A Sprite should not receive a message that it itself broadcast.
- True   False   According to Professor Ben Snyder (our 1st guest lecturer), computation can help decipher ancient texts.
- True   False   According to Professor Bilge Multu (our 2nd guest lecturer), robots should have manners.
- True   False   According to the definition given in lecture, tic-tac-toe is a strategy game.
- True   False   According to the definition given in lecture, poker is a strategy game.
- True   False   The minimax algorithm is named as such because it minimizes the number of states in the game tree and maximizes the computer’s probability of winning.
Question 2: You dropped some food on the floor. Should you eat it?
Consider the Scratch program shown in the appendix. (You may remove it for reference.) The program recommends whether or not you should eat a piece of food that you just dropped on the floor. To answer the following questions, you may find it useful to sketch the corresponding decision tree, but you are not required to do so.

A) If someone answered the series of questions with the answers “No”, “Yes”, “No”, “No” then what would be the recommendation?

B) If someone answered the series of questions with the answers “Maybe”, “Yes” then what would be the next question asked?

C) If the user is asked the question “Are you a puma?” then what is known about the current situation?
Give as much information as you can.

D) In any one run of the program, what is the fewest number of questions the user could be asked?

E) In any one run of the program, what is the greatest number of questions the user could be asked?
Question 3: Some of these things are not like the others…

Assume you have a cat Sprite that is running the following script.

For each of the following scripts activated by “When Green Flag clicked”, circle those that result in the same behavior as the original script. Cross out those scripts that result in different behavior.
Question 4: How do the variables vary?
Consider the following Script which uses three variables called X, Mystery, and counter.

For the following input values of x, fill in the table to show the value of each variable at the end of each iteration of the repeat loop. You may not need all of the rows of the table. You may find it useful to show the initial values of each variable in the header row of the table.

A) \( x=3 \)

<table>
<thead>
<tr>
<th>Loop #</th>
<th>Mystery</th>
<th>X</th>
<th>counter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B) \( x=4 \)

<table>
<thead>
<tr>
<th>Loop #</th>
<th>Mystery</th>
<th>X</th>
<th>counter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

C) \( x=5 \)

<table>
<thead>
<tr>
<th>Loop #</th>
<th>Mystery</th>
<th>X</th>
<th>counter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
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<td></td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>4</td>
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</tr>
</tbody>
</table>

D) This script makes an assumption about the value of X that the user specifies as input. A user could break this script by giving certain values of X. For what initial values of X would the “repeat until” loop never terminate?
**Question 5: Your Guess is as Good as Mine**

Consider the script included in the last part of the appendix attached to this exam. The script can be used to calculate the probability of all the coins showing as Heads when a coin is flipped a specified number of times. (It is the same script that was shown in lecture.)

A) Imagine you want to calculate the probability of flipping 3 (three) HEADS in a row – that is, if you flip a fair coin three times, the probability that all three flips turn up heads. How would you specify the inputs “Trials” and “Flip Count” for the script to perform this calculation for you? Give precise numbers!

B) This script only works correctly if the call to “pick random HEADS to TAILS” returns a random stream of HEADS (0) or TAILS (1). Imagine that the Scratch instruction block “pick random” is broken and always returns HEADS (0). When you use the script, what will it calculate as the probability of flipping three HEADS in a row?

C) Imagine the block “pick random” is broken and always returns TAILS (1). When you use the script, what will it calculate as the probability of flipping three HEADS in a row?

D) Imagine the block “pick random” is broken and it returns numbers in the strictly alternating series: HEADS (0), TAILS (1), HEADS (0), TAILS (1), HEADS (0), TAILS (1), and so forth. When you use the script, what will it calculate as the probability of flipping three HEADS in a row?

E) Imagine the block “pick random” is broken and it returns numbers in groups of three: HEADS (0), HEADS (0), HEADS (0), then TAILS (1), TAILS (1), TAILS (1), and then HEADS (0), HEADS (0), HEADS (0), then TAILS (1), TAILS (1), TAILS (1), and so forth. When you use the script, what will it calculate as the probability of flipping three HEADS in a row?
Code Appendix for Question 2. This page may be removed for reference.
Code Appendix for Question 5. This page may be removed for reference.