CS 202: Introduction to Computation
Fall 2012: Exam #1

Name: _____

Question	Possible Points	Received Points
1	48	
2	27	
3	36	
4	50	
5	20	
6	20	
Total	181	

This exam is closed notes. All cell phones must be turned off.

You have 90 minutes to complete the 6 questions on this exam. Note that different questions are worth different amounts of points.

Please write all of your answers on the pages of this exam. Write your answers clearly!

Good luck!

Question 1: Truth or Consequences [48 points]
Consider whether each of the following statements is True or False. Circle the best answer.

True False Currently, computers can label objects in pictures better than humans can.

True False Currently, robots can play soccer better than humans can.

True False An algorithm is a problem that must be solved.

True False Solving a rubix cube is an example of an algorithm.

True False Algorithms must be expressed using computer programming languages.

True False An algorithm may produce different outputs given different inputs.

True False An algorithm may contain randomness.

True False The Random Walk algorithm will find the shortest path out of a maze.

True False The Follow-right-wall algorithm must remember paths that have been previously explored in the maze.

True False In Scratch, the "ask" block stores the user's response in the "question" variable.

True False In Scratch, there is a Control block to repeat operations some number of times.

True False In Scratch, a Sprite can have more than one Costume.

True False In Scratch, a Sprite can use different instruction blocks to move around the stage.

True False In Scratch, a Sprite must put the "pen down" before it can "stamp".

True False An example of Computer Output is when the user clicks the mouse.

True False In Scratch, multiple Sprites cannot receive the same message

True False In Scratch, the Stage can broadcast messages to Sprites.

True False In a decision tree, the initial state is encoded in the leaves of the tree.

True False In a decision tree, edges between nodes correspond to the questions that are asked.

True False A variable can be thought of as a container in memory holding different values over time.

True False In Scratch, variables cannot be used to represent negative numbers.

True False In the Monte Hall challenge, the best strategy is to switch doors when prompted.

True False According to the definition given in lecture, monopoly is a strategy game.

True False According to the definition given in lecture, roulette is a strategy game.

Question 2: We Recommend Computer Science, Not Medicine [27 points]

Consider the Scratch program shown in the appendix. (You may remove it for reference.) The program recommends the medical field an undecided student should specialize in, depending on their personality. 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 "Sane", "Not so much", and "The Light" then what would be the recommendation?

B) If someone answered the series of questions with the answers "Sane", "The Light", and "Not so much" then what would be the recommendation?

C) If someone answered the series of questions with the answers "Sane" and "Very" then what would be the next question asked?

D) If someone answered the first question with the answer "Tired", then what would be the next question asked?

E) If the user is asked the "Who do you hate?" then what is known about this person? Give as much information as you can.

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

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

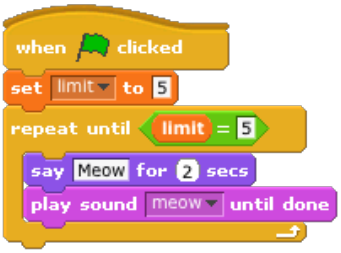
H) Are there any Scripts in this program that will never be run? If so, which?

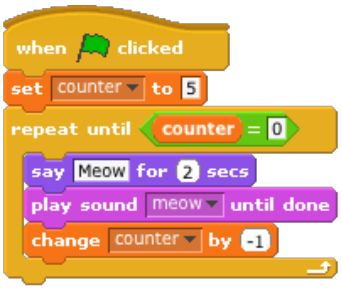
I) How many different specialties can this program recommend?

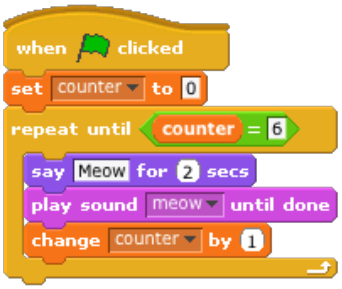
Question 3: How many times can you do this before you go crazy? [36 points]
Assume you have a cat Sprite that wants to say "Meow" and then play a sound recording of a meow, exactly five times.

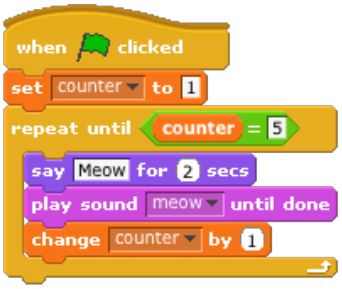
For each of the following twelve scripts activated by "When Green Flag clicked", **circle** those scripts that result in this desired behavior. Assume that each script is run separately (that is, there is no concurrency). Hint: The first script is correct.

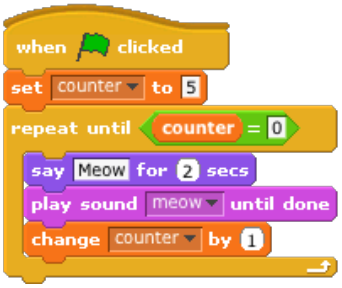
Cross out those scripts that do not follow this specification. For those scripts that are different, state **how many times** the cat will play the meow sound recording.











Question 4: How do the variables vary? [50 points]

Consider the script included at the appendix. It uses has six variables: word, x, mystery, mystery too, letter, and temp. Hint: The instruction block "letter <i> of <word>" returns the i-th letter of that word.

For the following input values of "word", 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 (i.e., before the repeat loop begins) in the header row of the table.

A) Word = ant

Loop #	word	letter	mystery	mystery too
1				
2				
3				
4				
5				
6				

B) Word = aabbcc

Loop #	word	letter	mystery	mystery too
1				
2				
3				
4				
5				
6				

C) Word = wwww

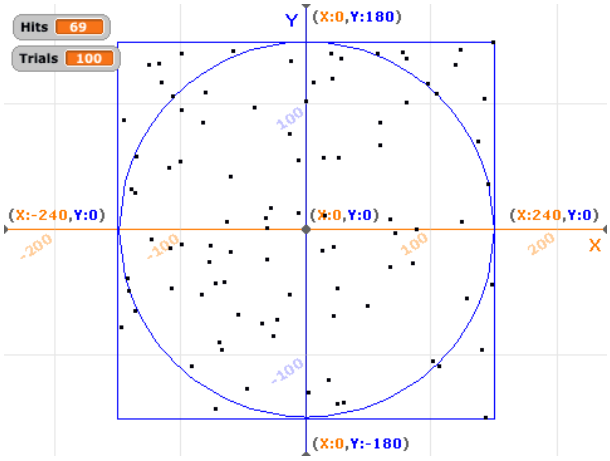
Loop #	word	letter	mystery	mystery too
1				
2				
3				
4				
5				
6				

D) When the script is done running, what does the value of "mystery" correspond to? Use natural language English to describe the value of "mystery" in terms of the input.

E) What does the value of "mystery too" correspond to? Use natural language English to describe the value of "mystery too" in terms of the input.

Question 5: Circle or Square? [20 points]

Consider the script included in the appendix. The script can be used to approximate the value of PI. It is the same script that was shown in lecture. This sample output might help you better visualize the script's behavior as a function of the values of X and Y.



A) Imagine you want to calculate the probability of PI and you set the number of Trials to 4. What different values of PI is the program capable of producing? (For example, if you ran the program many different times, but always with Trials=4, what are all the different values for PI it might calculate?)

B) This script only works correctly if the call to "pick random -150 to 150" returns a random stream of numbers between -150 and 150 for both X and Y. Imagine that the Scratch instruction block "pick random" is broken and always returns 0. When you use the script, what will it calculate as the value of PI?

C) Imagine the block "pick random" is broken and always returns 150. When you use the script, what will it calculate as the value of PI?

D) Imagine the block "pick random" is broken and it alternates returning 20 and 0 (such that X is always assigned 20 and Y is always assigned 0). When you use the script, what will it calculate as the value of PI?

Question 6: Win or Lose? [20 points]

Imagine you are playing the Subtraction game (the variant of Nim) we investigated in Lecture. In this strategy game, two players take turns removing 1, 2, or 3 objects from a shared pile; the player who removes the last object wins.

In this particular game, assume you start with 10 shared objects (unlike the 7 objects we experimented with in class). Assume you took the first turn and removed 2 objects; your opponent went second and removed 3 objects; thus, there are 5 objects still remaining.

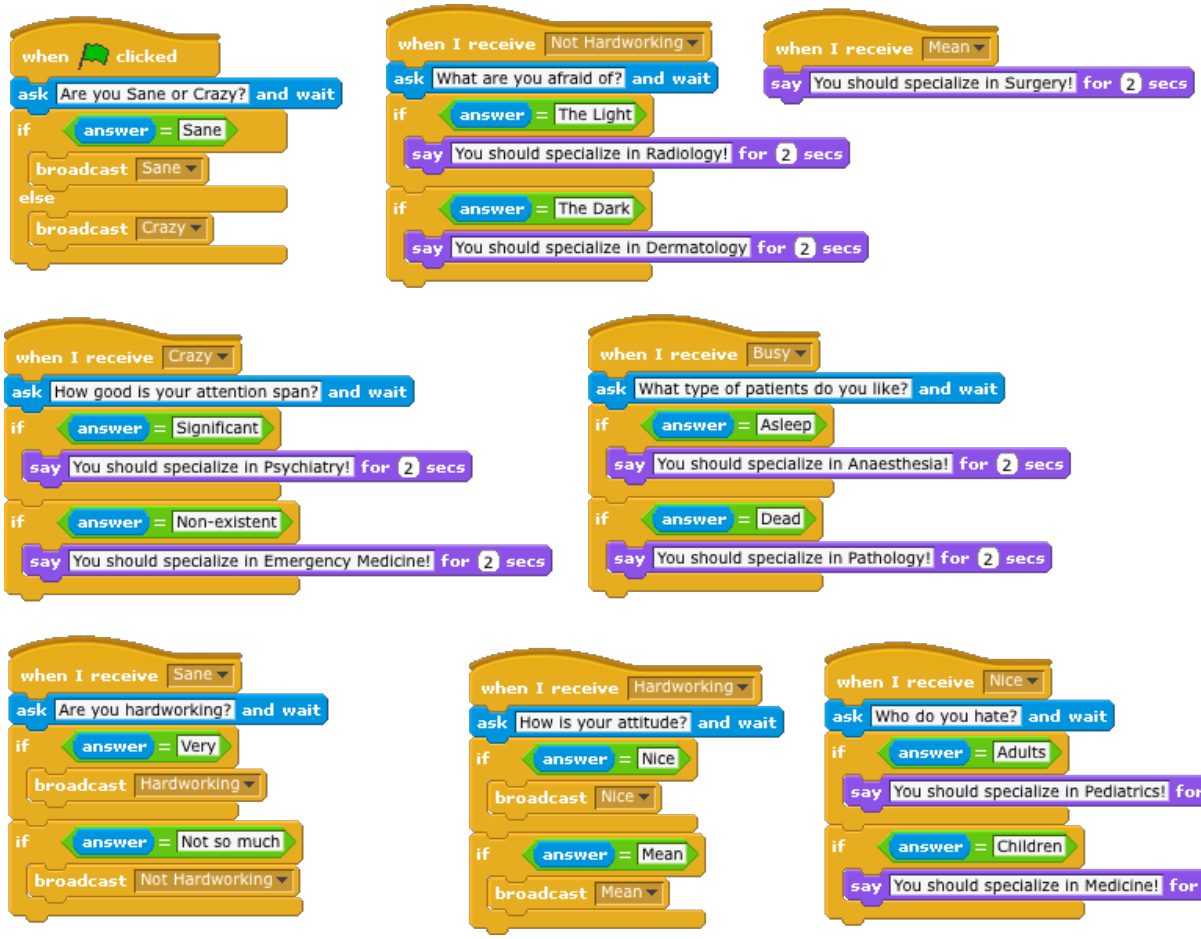
A) Your task is to draw the game tree for the remaining moves. To make your game tree clear, use an "X" to represent each object that you pick up and an "O" to represent each object your opponent picks up. Thus, at this point (after 2 turns), the game boards looks like this: XXOOO.

   Your game tree should show each of the possible moves for you (X) on the next turn (i.e., turn 3). For turn 4, show the possible moves for O; if O can win on this turn, you only need to show O's winning move. For turn 5, show the moves that X could make; again, if X can win on this turn, only show X's winning move. Repeat for each turn as needed.

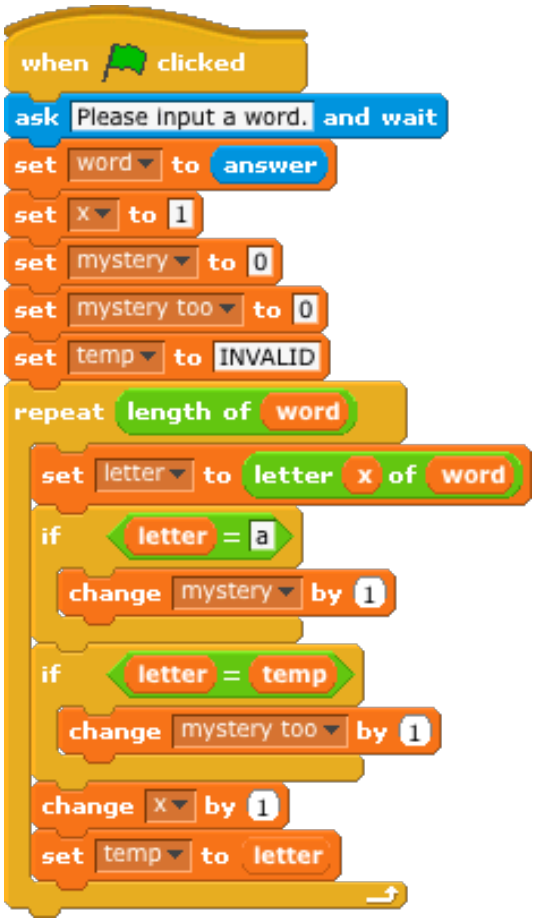
B) If you, as player X, make the best moves according to the game tree (e.g., with the minimax algorithm), are you guaranteed to win? Why or why not? What move should you as player X make?

C) If player O makes their best moves according to the game tree, (e.g., with the minimax algorithm), are they guaranteed to win? Why or why not? What move should player O make?

Code Appendix for Question 2. This page may be removed for reference.



Code Appendix for Question 4. This page may be removed for reference.



Code Appendix for Question 5. This page may be removed for reference.