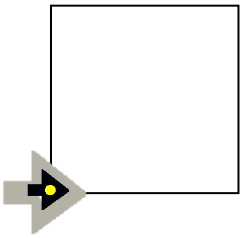
CS39n - Midterm – SOLUTION 2009/10/26

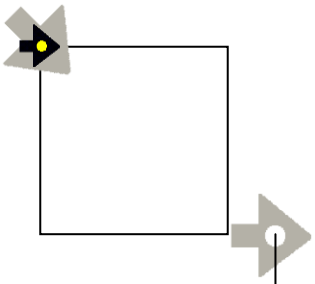
1. a) The gray arrow represents the FINAL location of the arrow.

```
pen down
change x by side-length
change y by side-length
change x by 0 - side-length
change y by 0 - side-length
```



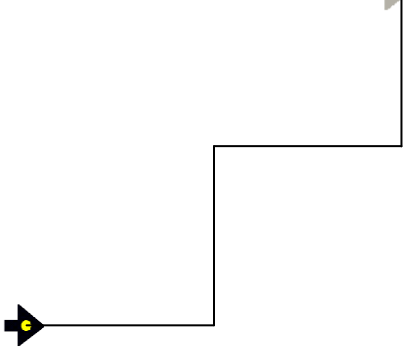
b)

```
pen down
turn 45 degrees
change x by side-length
change y by side-length
change x by 0 - side-length
change y by 0 - side-length
```



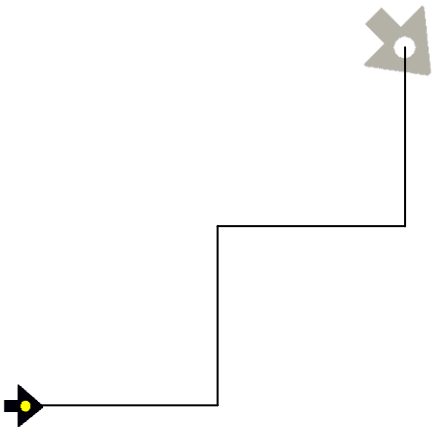
c)

```
pen down
repeat 2
    change x by side-length
    turn 90 degrees
    change y by side-length
    turn 90 degrees
```



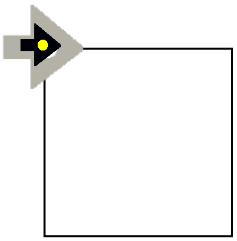
d)

```
pen down
turn 45 degrees
repeat 2
    change x by side-length
    turn 90 degrees
    change y by side-length
    turn 90 degrees
```

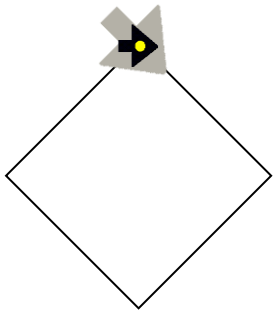


e)

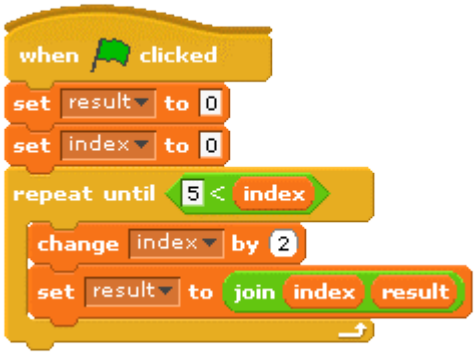
```
pen down
repeat 4
    move side-length steps
    turn 90 degrees
```



f)



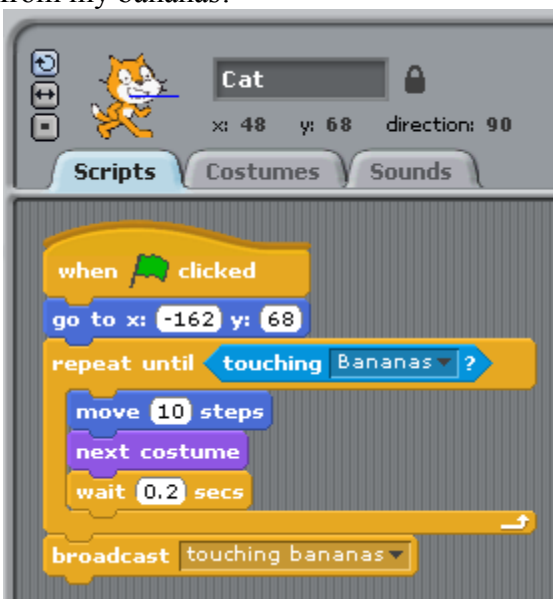
2. Solution: The value of result is: 6420 This was pretty tricky because the starting value of result (the zero) matters! Another tricky part was that the last line sets the result to be the join of *index* and *result*. As a result the next value of index is added to the FRONT of the existing numbers.



CS39n - Midterm - PART 2

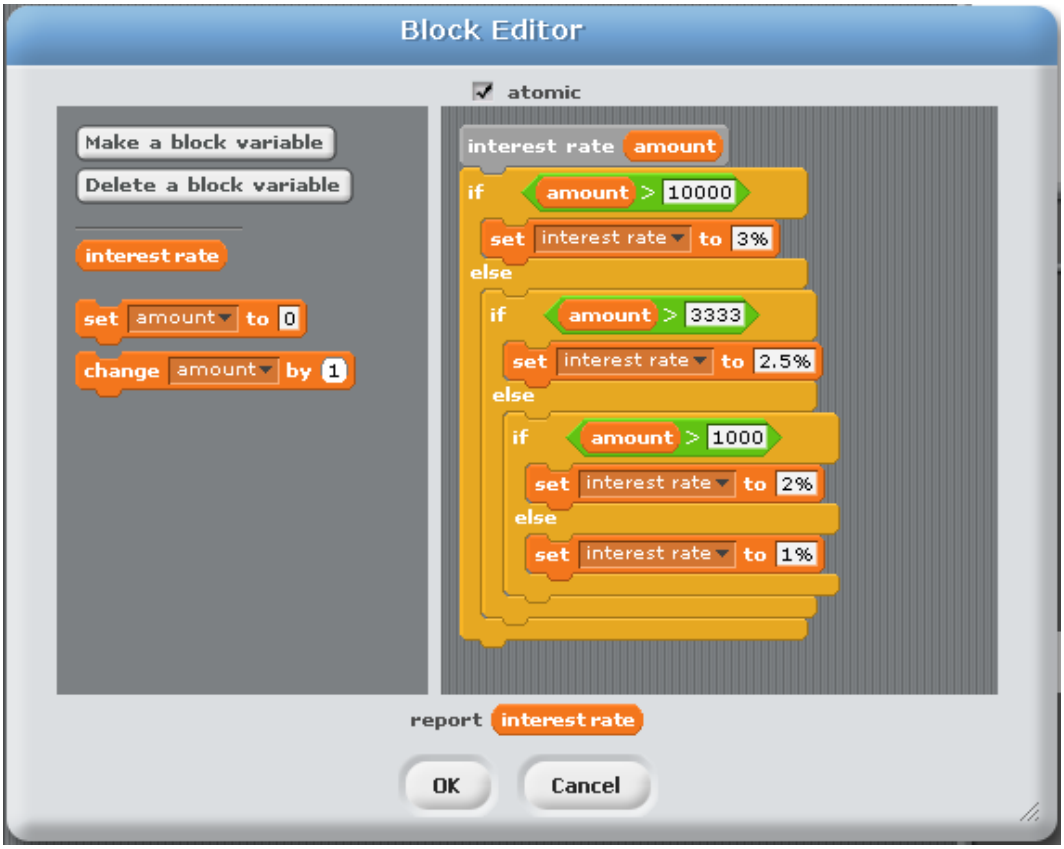
Programming:

3. Solution: we could have either the cat or the bananas detect when they touch and broadcast a message to the monkey. It is important that the cat knows to stop walking when it touches the bananas so we might as well have it broadcast the message to the monkey. When the monkey receives the message it should say "Get away from my bananas!"



4. Solution: We can use lists to keep track of the mapping between the numbers 1-3 and the words “rock”, “paper” and “scissors”. Instead of having 3 if’s for each character, we can have them use their random number to index into a list that contains “rock”, “paper” and “scissors”.

5. Solution:



Short Answer:

6. Aside from the reasons we discussed in class (simulations for training and Luis von Ahn's games with a purpose), what is a great use of games, in terms of a benefit to society / individuals?

Possible Answers:

(1) Wii fit (keeps people in shape), (2) Games more and more have a social component, which can contribute to the feeling of being part of a community (for isolated individuals), (3) Games provide livelihoods to developers, retailers, artists, etc. (4) Designing games is a tremendous creative outlet (5) Games allow escapism (6) They can serve to define a generation (7) They can teach logical, computational thinking (8) Games can be a great way (read: Siren Song) for people to get interested in computing

7. What is a disadvantage of duplicating a sprite many times? If you could redesign Scratch, how would you eliminate this problem?

Possible Disadvantages

- It becomes difficult to change the costumes because you have to change each one individually
- It becomes difficult to keep all of the code the same for each sprite because if you need to make one change you must remember to change each one individually.

Possible Solutions

- Have one "master" sprite where all of the other sprites can share one copy of costumes and scripts.
- Have a hierarchy of sprites so that individual sprites can automatically have the functionality of things higher in the hierarchy and can make modifications as they wish.
- Have Scratch keep track of which sprites have been copied so that you can easily monitor and change the differences between the scripts/costumes for each script.

8.

We want a character to say the first word in the sentence ("Go" in the examples below). Other characters may also be using first.

a)

Solution: We will accept the answers of both "sometimes" and "never". When we broadcast "first", the first script starts to compute the value of result. There is no guarantee that this script has finished computing the value of result before we try to say the value in the result variable.

b)

Solution: "sometimes". When we broadcast "first", the first script starts to compute the value of result and luckily this time we wait for it to finish before trying to say the value in the result variable. Unfortunately there may be many other sprites/scripts trying to use the same variables of sentence and result. Consider the scenario where one sprite broadcasts the message "first" and then before the script that receives "first" finishes executing another sprite broadcasts first. Scratch really should handle this better, but what currently happens is that one of the scripts that broadcasted "first" will never finish and will therefore never say "result". The more generic answer is that the result of first might be from your call to first and it might be from another sprite's call to first.

c)

Solution: This always works. The reason is that by using the block first, even if someone else changes the value of "sentence" the block can still execute without being interrupted or messed up.

9. In a hybrid car, the electric motor can also serve as a generator to recharge the battery, by letting the wheels turn the motor instead of the other way around. This takes energy away from the wheels, slowing the car. To make this happen, you push the brake pedal. But you're not really applying the brakes -- you're charging the battery from the car's energy of motion. So why didn't they make a separate control for this, instead of giving an extra meaning to the brake pedal?

Solution: As we discussed in class, part of how cars are designed is that there is an abstraction so that cars don't need to know how people work and that people don't need to know how cars work. By providing a different pedal would increase the amount that people needed to know about a car in order to be able to drive it. So the extra pedal breaks the abstraction between humans and cars. Presumably the car can figure out when you should press the brake and when you should just convert the energy to charge the battery and can probably do so better than a human driver would be able to do.

10. "I don't do anything I'm ashamed of; why should I worry about privacy?" Give at least two answers to that question.
Possible Answers:

- With less privacy comes the increased opportunity for others to steal your identity.
- We behave differently in different contexts. What is appropriate in one context may be inappropriate in another. In the future you will be in different situations, one of which may make some of your behavior that is captured online inappropriate.
- With less privacy it is easier for others to inappropriately/illegally discriminate against you based upon non-shameful aspects of your identity.

11. What's the difference between strongly and weakly solving a game?

Solution: Strongly solving involves visiting EVERY position, and knowing what to do in every situation. Weakly solving means you can prove things about the game (e.g., Checkers is a tie game) but may not know how to play every possible game perfectly.

12. In the future, when computers have thousands of cores (simultaneous processing modules), which of the programming paradigms will be easiest to automatically parallelize and why?

Solution: Functional, because it has no state, so parallel computations can't step on each other's toes with their independent computations. Independent sub-blocks can be computed in parallel and combined.

13. We've talked about the positive benefits of the applications that changed the world. Choose one of the applications that we've talked about and describe its negative side-effects.

Solution: There are many answers that will be accepted. Below is a list of ones that we thought might appear.

- WIMP : carpal tunnel
- EMAIL : email fatigue
- WEB : once a secret is out, it's out forever
- FACEBOOK : sexual predators
- WEB MAPPING : privacy
- SW-as-SERVICE : company (in this case google) sees your document
- TEXTING : train crashes