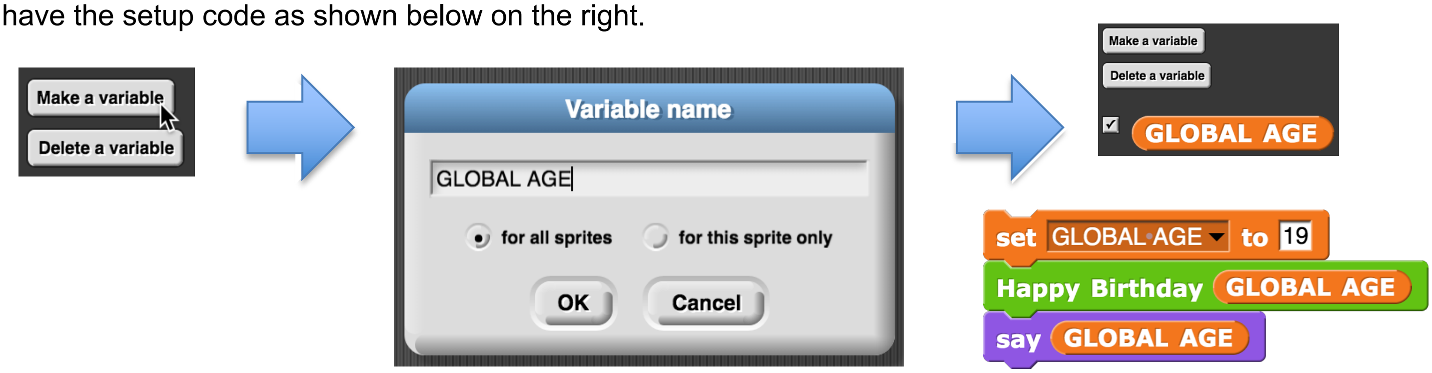
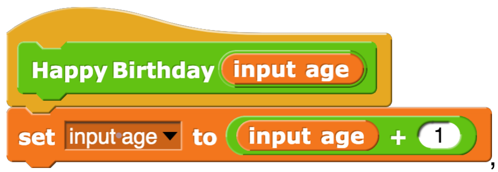
CS10 Fall 2018 Midterm 1 Answers

For questions 1 and 2, we make a global variable **`GLOBAL AGE`** by clicking the "**Make a variable**" button and have the setup code as shown below on the right.





Question 1: If **`Happy Birthday`** is [the block above], what happens? (select ONE)
It says 19, because **`input age`** is a parameter, whose scope is local to the command block. The variable **`input age`** gets set to 20, but that doesn't change the value of **`GLOBAL AGE`**, which is what gets said.

Question 2: If **`Happy Birthday`** is [the block above], what happens? (select ONE)
It also says 19, because **`input age`** is a parameter, whose scope is local to the command block. The variable **`input age`** gets set to 20, but that doesn't change the value of **`GLOBAL AGE`**, which is what gets said.

Question 3: Which is NOT a benefit of Massive Open Online Courses (MOOCs)? (select ONE)
MOOCs often emphasize lectures, where the real learning happens. This is not a benefit -- real learning happens by doing problems, by talking about and analyzing the concept you're studying to probe the strengths and weaknesses, by teaching others, and by authentic activities that are as close to possible to the thing you are being asked to do. It does not happen by passively listening to a talking head, which is unfortunately where a lot of MOOCs focus. The rest of the options were benefits.

Question 4: What is a true statement regarding abstraction? (select ONE)
- ○ Snap*!* blocks can be *used* without worrying about their specifications. FALSE, the specification tells the user how to use a block.
- ○ Snap*!* blocks can be *authored* without worrying about their specifications. FALSE, the goal of the specification is to direct the author of the block what they're supposed to do!
- ○ Generalization in Snap*!* is embodied by the ability to hide HOW a block works from a user. FALSE, that's what *detail removal* is – when you close the "Block Editor" window, it doesn't matter *how* the block does what it does, it only matters that it adheres to the spec.
- ○ Removal of detail in Snap*!* is embodied by input parameters so one solution solves many problems. FALSE, that's what generalization is – adding input parameters allows a solution to be generalized.
- ● **None of these**

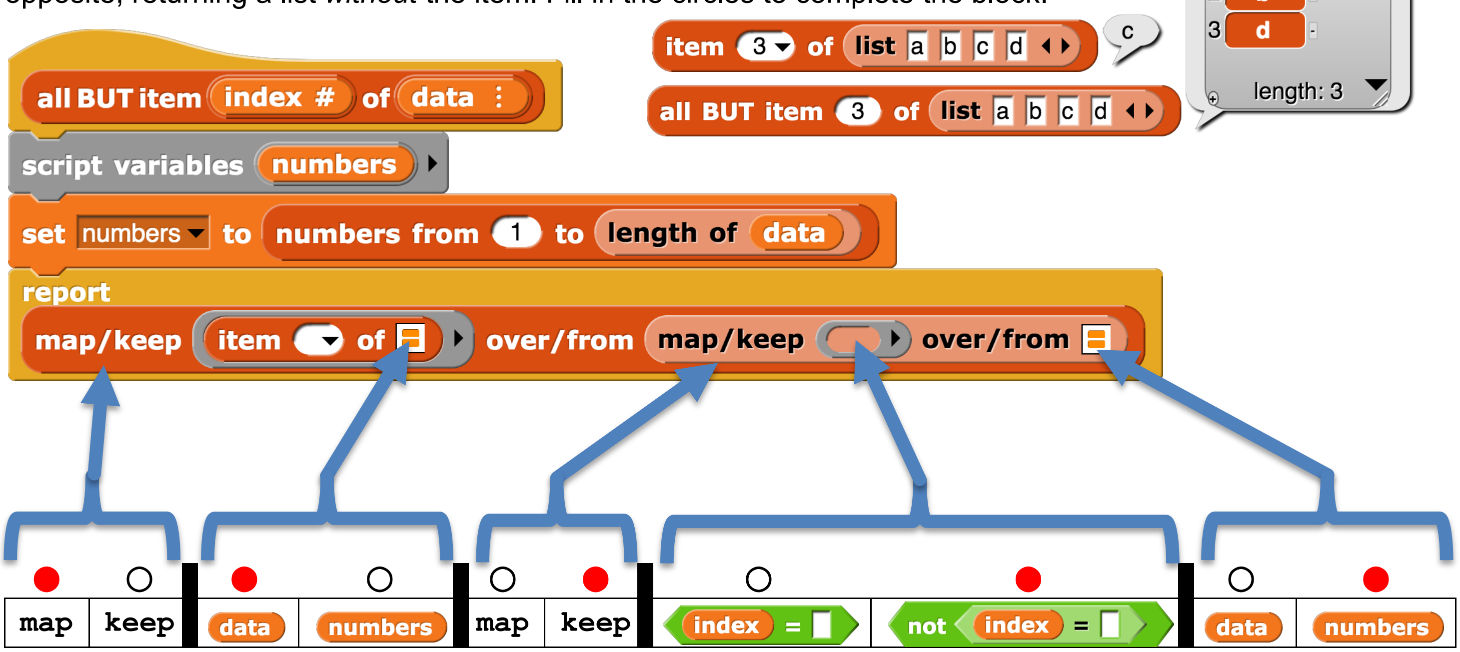
Question 5: What can you conclude about the correctness of a reporter block with no inputs? (select ONE)
● **If *it is guaranteed to be a function, and works once*, it will always work.** TRUE, a function has the property that the same input yields the same output. With no inputs, the outputs will always be the same, so if it works once, it'll always work.
○ If *it is not guaranteed to be a function, and works once*, it will always work. FALSE, if it's not a function, its output may have some randomness or be a result of some prior state.

○ If *it is tested and works one million times*, it will always work. FALSE, the 1,000,001st time may reveal the bug.
○ “Testing shows the presence, not the absence of bugs”, so *no amount of testing can prove it’ll always work*. FALSE, this is mostly the case, but functions (verified through glass box testing) with a discrete set of inputs can be exhaustively tested.
○ None of these

Question 6: What true statement was shared in the Privacy lecture? (select ONE)

○ The online world and the real world are different, so as long as your username doesn’t tell anything about you, you don’t put anything about yourself in your online “profile” (e.g., photo, address, etc), and what you post isn’t connected to you, you can safely remain anonymous online. FALSE, the online world is inseparable from the real world. There are many other ways to trace an online account to a person; IP address, style of writing, typing frequency, photos of friends and surrounding locations, hidden geotags, plus your phone company knows roughly where you are at all times to triangulate the signal to you.
○ Thankfully, there are many entities (e.g., the government, your school, your employer, your bank, etc.) looking out for your privacy, so you don’t have to actively maintain it. FALSE, only *you* have an interest in maintaining your privacy.
○ You can avoid having an information footprint simply by not going online and avoiding using digital devices. FALSE, you can’t avoid having an information footprint by not going online. Security cameras will capture you, people will talk about you and perhaps take photos of you, and your credit cards and supermarket rewards card number are tracked to you.
○ If you share something online accidentally, but quickly delete it, you still have control over that information. FALSE, once something is made digital and is shared, you instantly lose control over that information.
● **None of these**

<u>Question 7: All BUT item (Beavis: “Heh heh, he said ‘but’…”)</u> (6 pts)
Snap*!* provides a block for picking an item from a list, but it doesn’t provide a block for the opposite, returning a list *without* the item. Fill in the circles to complete the block.



Question 8: Match each programming paradigm with a problem best suited to it. (select ONE per row, 4 pts)

	Functional	Imperative	Object-Oriented	Declarative
Easily program 1,000 computers because reporter and predicate outputs are only due to inputs, not to any previous states	●	○	○	○
Putting data in which can be queried later, like finding all your cousins from your family tree	○	○	○	●

Drawing a complicated picture on the screen using pen up/down and move/turn commands	○	●	○	○
Authoring a role-playing game with different interacting creatures, like zombies & skeletons	○	○	●	○

Question 9: *What's our clearance, Clarence? What's our vector, Victor? Roger. Huh?* (10 pts) SID _______

Airlines feed their passengers in a unique way in first class. It begins with the single "first class steward" walking down the aisle, taking the meal orders by asking each passenger, one by one. Then the steward walks back to galley (mini-kitchen) at the front, prepares each meal one by one, and walks back and forth with a single tray for each passenger. When we say "steps", we mean *physical steps that are walked*, like what your Fitbit would record. (By the way, none of the answers below depend on how many people [2 up to 8] are in each row)

Here's a fun random fact: As a boy, Gauss (the mathematician) came up with this: $1+2+\ldots+N = \frac{N(N+1)}{2}$

a) How many (worst case) steps are needed to *take the orders* as a function of the number of passengers?

Constant	Logarithmic	Linear	Quadratic	Cubic	Exponential
○	○	●	○	○	○

The steward just walks down the aisle and asks for the order from everyone, walking no more than N/2 to N/8 steps in total. Any constant times a linear function is a linear function.

b) How many (worst case) steps are needed to *deliver the meals* as a function of the number of passengers?

Constant	Logarithmic	Linear	Quadratic	Cubic	Exponential
○	○	○	●	○	○

To deliver the meals, the steward walks 1 step down and 1 step back for the first row, then 2 steps down and 2 steps back for the second row, etc. $1+2+\ldots+N = \frac{N(N+1)}{2}$, so that's a quadratic function.

c) Sometimes, when a passenger has been delivered a meal, they also ask for chopsticks, which are normally not put on the tray. In these cases, the steward has to return to the galley, pick up the chopsticks, deliver them, and then return to the galley to get the next passenger's meal. Now how many (worst case) steps are needed to *deliver the meals* as a function of the number of passengers?

Constant	Logarithmic	Linear	Quadratic	Cubic	Exponential
○	○	○	●	○	○

This is just double the amount of steps from the problem above, and constants never change the algorithmic complexity category.

d) Every person sitting on the window seat has the option of hitting the new electronic shutter which makes the window opaque (light can't go in or out) or clear. If you look at the windows of the plane from the outside, it looks like a binary number (clear = light = 1, opaque = dark = 0). How many different binary numbers can be made, as a function of the number of passengers?

Constant	Logarithmic	Linear	Quadratic	Cubic	Exponential
○	○	○	○	○	●

Each window is like a bit in a binary number, and with N bits there are 2^N different numbers.

e) Does the answer to question (a) change if instead they hire a second steward to help who starts from the back, with the idea that there is an identical galley in the back with the same food as in the front, and the stewards stop when they meet each other somewhere near the middle? In the worst case, the other steward doesn't help at all, so the answer wouldn't change at all. In the average case where they meet in the middle, it only changes the amount the first steward walks by a half, which doesn't change the complexity.

Yes	No
○	●