Question 10: If the output from Test is false, which can you say for sure? A and B are Booleans. (select ALL that apply)
If Test is false, then both terms of the or must be false, since or is a “true finder” and returns true if any of its inputs are true. So we know A must be false. We also know that A=B is false, so that means A ≠ B, and if A must be false, then B must be true!

- A must be true
- B must be true
- A must be false
- B must be false
- None of these

Question 11: Fill in the blanks so the predicate is the same as the original Test block. (select ONE from each)

So if Test only returns false when A is false and B is true, then it returns true all other cases. The initial “if not B” then case is only reached if B is false, which is when Test is supposed to return true (since it’s not the A false B true case), so the first report should be true. In the else case, that’s when B is true, but we know that if A is false it returns false (we learned from the last problem), and if A is true it’s true, so we just return A.

Question 12: What does Mystery report, if B is a non-negative integer (i.e., 0, 1, 2, …)? (select ONE, 4 pts)
A is incremented with the value B for B iterations, so the first time it’s A+B, then it’s A+2B, then A+3B, … until it’s A+B*B = A+B²

- A+B
- A×B
- A^B
- B^2
- A+B³
- A+B^A
- A+B^B
- The sum of all the numbers from A to B
- Error
- Infinite Loop

Question 13: What is 256₁₀ + 10000₂? (select ONE, 2 pts) Hint: 16₁₀ × 16₁₀ = 256₁₀
We’re asked to convert these numbers to hexadecimal. Hexadecimal of 256₁₀ is 100₁₆, since the columns of hex are 16³ = 4096₁₀ | 16² = 256₁₀ | 16¹ = 16₁₀ | 16⁰ = 1₁₀. The number 10000₂ is 10₁₆, and 100 + 10 (in any base) is 110.
c) What does the combine expression return? (Choose ONE)
This came straight from lecture, combine (joinswap) items of (a b c d) = a joinswap b joinswap c joinswap d. Let's evaluate it using a right-associative model. That's (a joinswap (b joinswap (c joinswap d))). That becomes (a joinswap (b joinswap dc)) which becomes (a joinswap dcb) which becomes dcba. Now let's evaluate it in a tournament-style manner: (a joinswap (b joinswap (c joinswap d))), which is ba joinswap dc, which is dcba.

joinswap is an associative function!

d) What does the expression above return, taken straight from lecture with a different input? (Choose ONE)
The combiner creates a frankenstein function, in which the list (f(x) g(x) h(x)) becomes f(g(h(x))). So this is reverse(stutter(duplicate(ucb))) → reverse(stutter(ucbucb)) → reverse(uucbucb) → bcubcuu.

c) The developer of Snap! removes the restriction that two scripts cannot run at the same time, claiming it will increase performance. What could now happen? Note: this problem is independent of the block below. (Choose ALL that apply)
This opens the floodgates to all the concurrency problems that come up with parallel and distributed computing, unfortunately, yikes!

e) In fact to show this, you set up a fake bank with $100 in it, and have TWO people simultaneously take $10 out of their accounts using the block above. What are the possible values of BALANCE afterward? (choose ALL that apply) If they run this one after the other, the first one would withdraw money setting the BALANCE to 90, then the second would run this and set the BALANCE to 80. If they happened to run at the same time, they could both read the value of BALANCE to be 100 at the same time, and both then set the BALANCE to 90. Hey, a free $10!
g) In computational science, computers are used to understand things that are ______ for experiments: (choose ONE)

- too data-intensive
- too trivial
- too cheap
- too slow
- too experimental
- too random

**Question 15: We put the fun in functional programming...** (10 pts)

We start with our standard square and add a fun flourish before we make our turn. The sprite starts at the top left of the biggest square facing right. Code and pictures.

Fill in the slot in the row and column corresponding to the expression or block you'd like to place in the code below. Slots b and d are round but they can take a hexagonal-shaped predicate if that's what you need. (Select ONE per column; you might not need all rows).