WASHINGTON STATE MIDDLE SCHOOL COMPUTER SCIENCE COMPETITION

May 30, 2015

Individual Challenge

Grades 7-8

30 Minutes

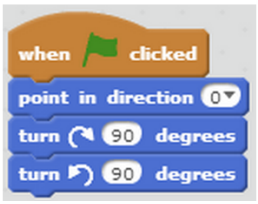
Please read these directions carefully before beginning. Breaking any of the rules is grounds for disqualification.

- Do not turn this page and begin working the test until the start of the test is announced. Once time starts, you will have 30 minutes to complete this test.
- There is no talking allowed at any time. If you have a question about the test, please raise your hand.
- If you put a smiley face next to your answer for question 14, you get bonus points!
- No electronic devices of any kind (calculators, phones, computers, etc.) are allowed during the test.
- Write all of your answers on the answer sheet provided. Write as clearly as possible. If we can't read your answers, you will not receive points.
- Questions within each section are increasing in difficulty, and harder questions are worth more points.
- For all Scratch questions, assume that the script shown is the **only** script in the game.
- Do not feel bad if you don't finish the test - it is designed to be too long to finish in 30 minutes!

Scratch Questions

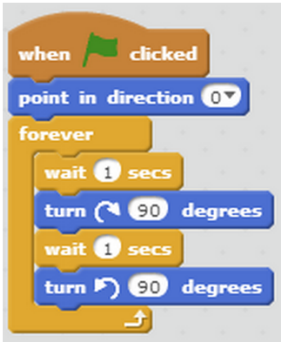
1. [1 point] What happens when the green flag is clicked?

2. [1 point] After this code executes, in what direction is the sprite pointing?



3. [2 points] How does the sprite with this code behave when the green flag is clicked?

   A. Spins forever
   B. Turns 90 degrees to the right every second
   C. Turns so fast you can't see it
   D. Turns left and then right over and over again



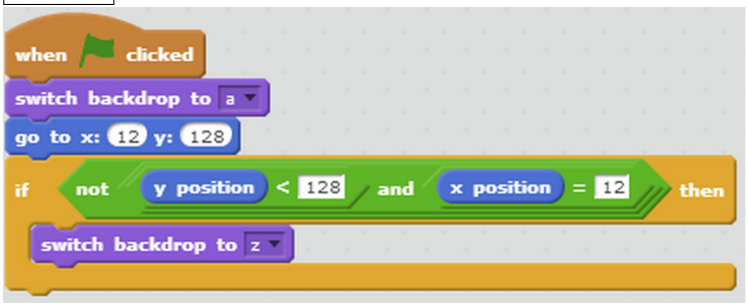
4. [2 points] Will the following expressions evaluate to **TRUE** or **FALSE**?

   A. Both true
   B. The left is true, right is false
   C. The right is true, left is false
   D. Both false

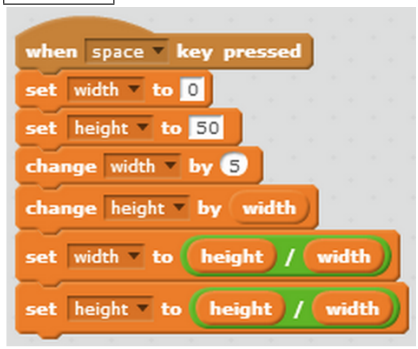
5. [2 points] What happens when the green flag is clicked?

   A. A baseball is hit
   B. The sprite hides
   C. Nothing

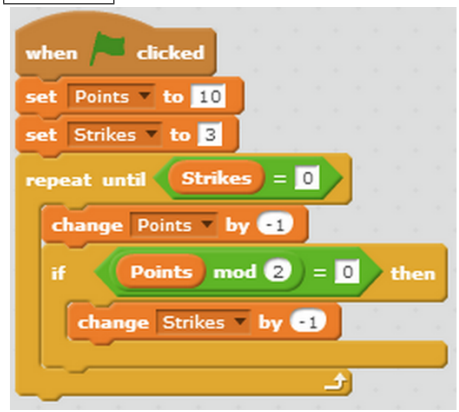
6. [3 points] After the following code executes, is the backdrop equal to **a** or **z**?



7. [4 points] After the following code executes, what are **Width** and **Height** equal to?



8. [4 points] After the following code executes, what are **Points** and **Strikes** equal to?

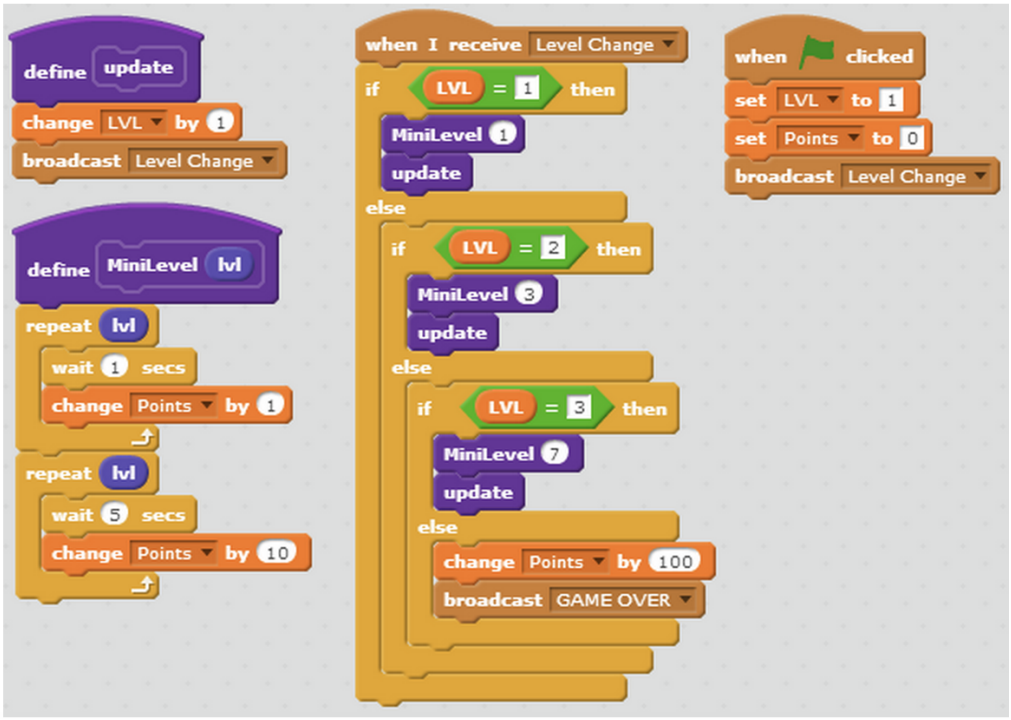


9. [5 points] How many clones exist 3.5 seconds after the green flag is clicked?

10. Read the code below and then answer the following two questions:

    (a) [4 points] How long does the code take to finish executing after the green flag is clicked?

    (b) [5 points] What does **Points** equal after the code finishes executing?



Pseudocode Questions

11. [1 point] What will happen if Jackie pulls the lever?

```
when Jackie pulls lever:
      machine turn on
when Jane pulls lever:
      machine self destruct
```

12. Read the following code and then answer parts (a)-(c).

```
if George walks through garden AND arboretum:
      collect 3 flowers
else if George walks through garden OR arboretum:
      collect 1 flower
```

(a) [1 point] George walks through the arboretum and the garden. How many flowers does he collect?

(b) [1 point] George walks through the forest. How many flowers does he collect?

(c) [1 point] George walks through the forest and the garden. How many flowers does he collect?

13. [2 points] What does `MNM` equal after the code below is executed?

```
MNM is set to 1
repeat 3 times:
      multiply MNM by 3
      add 1 to MNM
```

14. [3 points] What do `j` and `k` equal after the code below is executed?

```
j is set to 4
k is set to j
j is multiplied by 2
k is set to (j + k)
k is multiplied by 2
j is set to (j - k)
```

15. [3 points] What does `MYSTERY(5.5567)` produce?

```
x = 3
y = 4.12945
z = 100.00000
MYSTERY(x) ---> 3.00
MYSTERY(y) ---> 4.12
MYSTERY(z) ---> 100.00
```

16. [3 points] What does `MyFun(''find the pattern'')` produce?

```
s1 = "hello"
s2 = "aeiou and sometimes y"
s3 = "lvl = 5"
MyFun(s1) ---> "hXllX"
MyFun(s2) ---> "XXXXX Xnd sXmXtXmXs X"
MyFun(s3) ---> "lvl = 5"
```

17. [2 points] Below is the pseudocode for `MyFun`. Which line contains an error?

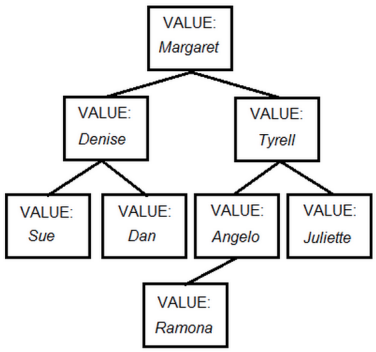
```
1     for every letter in phrase:
2           if that letter is not a, e, i, o, u, or y:
3                 replace that letter with X
```

18. 4 points A **map** is a container that holds keys and corresponding values. Every time Arnold goes to the gym, he saves the date and the amount of time he spent there in a map called `WorkoutData`. To see how much time he spent at the gym on a particular date, Arnold types in `WorkoutData(''date'')`. `WorkoutData` looks like this:

```
{("Jan 1" : "1h 30m") ("Jan 5" : "0h 45m") ("Feb 30" : "2h 11m")}
```

What should Arnold type in to see the amount of time he spent at the gym on January 1st?

19. A **tree** is a data structure. Below is a family tree, which models people and their relationships:



To access a person in the tree, you must start from the top (the "root" of the tree) and work your way down by moving to the left or right (following the left "branch" or right "branch.")

Examples:

- This expression accesses Denise: `tree.left.value`
- This expression accesses Dan: `tree.left.right.value`
- This expression accesses Sue: `tree.left.left.value`

(a) 4 points Write the expression to access Ramona.

(b) 1 point Write the expression to access Margaret.

20. 5 points Brian takes the bus to class every day. Where he lives, a bus ride cost $1.50. Usually the buses are organized so that Brian only has to take one bus to get to class. However, Brian has to take two buses on Saturdays. Fill in the missing line of the pseudocode for Brians situation below:

```
if today is Saturday
            money = ____________________
      otherwise
            money = $1.50
```

21. 5 points What will the following code print?

```
inverse(input) = -1/input
z = 8
while(z > 1):
      if z is prime:
            print(inverse(z))
            print(">")
      z = z - 1
print("complete")
```

Logic Questions

22. [1 point] Ella loves the Sounders.
Everyone who loves the Sounders wears green on game days.
Today is a game day.
What color is Ella wearing?

23. [1 point] Michael always eats cereal for breakfast.
Michael always eats macaroni for lunch.
Jess always eats what Michael eats.
Its lunch time! What is Jess eating?

24. [2 points] Hanz is a pianist.
The symphony orchestra only hires people who are either pianists or classically trained.
Hanz is not classically trained.
Could the symphony hire Hanz?

25. [2 points] Sally is a great white shark.
Mark is sneaky.
All great white sharks swim in the ocean.
Only great white sharks are sneaky.
Who swims in the ocean?

    A. Sally
    B. Mark
    C. Both
    D. Neither

26. [3 points] A pencil and an eraser together cost $1.10. The pencil costs $1.00 more than the eraser. How much does the eraser cost?

27. [3 points] What is `F(1,2,3)`?

```
fa(in) = in divided by 2
fb(in) = in times 3
F(a, b, c) = c plus fa(b) minus fb(a)
```

28. [4 points] Jordan, Sana, Ritu, and Victor are sitting side by side at a restaurant. Jordan will not sit next to Sana, Victor refuses to sit to the right of Ritu, Ritu will not sit on either end of the row, and Sana wants to sit by Victor. Which of the following seating arrangements makes everyone happy?

    A. Jordan, Sana, Ritu, Victor
    B. Jordan, Ritu, Sana, Victor
    C. Sana, Victor, Jordan, Ritu
    D. Sana, Victor, Ritu, Jordan

29. Brian has four data structures (ways to keep track of information) available to him:

List - it is very fast to store data in a list

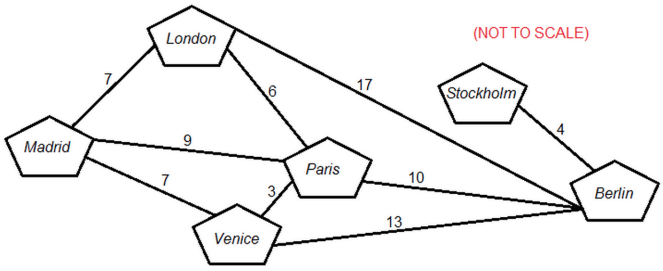
Tree - it is very fast to find and access data stored in a tree

Map - a map stores keys and corresponding values

(a) [2 points] Which data structure should he use to store his friends names with their phone numbers?

(b) [2 points] Which data structure should he use to store his New Years Resolutions? He only adds a new resolution at the beginning of each year, but he needs to see his resolutions every day to keep himself motivated!

30. [5 points] Ritu and Victor are on vacation in Europe.



(a) [5 points] They are trying to visit every city on their map at least once, but travel the **least distance possible**. What route should they take? Write down the first letter of each city, in order. **Start with Paris (P).**

(b) [5 points] Which city could Ritu and Victor eliminate from their vacation to save the most distance traveled?

31. [5 points] There are 10 sets of 10 coins. You know how much the coins should weigh. You know all the coins in one set of ten are exactly a hundredth ($\frac{1}{100}$) of an ounce off, making the **entire set of ten coins** one tenth ($\frac{1}{10}$) of an ounce off. You also know that all the other coins weight the correct amount. You are allowed to use an extremely accurate digital weighing machine only once. How do you determine which set of 10 coins is faulty?