WASHINGTON STATE MIDDLE SCHOOL
COMPUTER SCIENCE COMPETITION

May 14, 2016

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!

Section 1: Scratch Questions

S1. (1 pt) What happens after the green flag is clicked?
- a) Nothing
- b) The sprite glides to the middle of the screen
- c) The sprite glides to the bottom left edge of the screen
- d) The sprite glides back and forth forever

S2. (1 pt) What happens after the green flag is clicked?
- a) Nothing
- b) The sprite moves 10 steps to the right one time
- c) The sprite moves right forever
- d) The sprite moves right until it reaches the edge of the screen
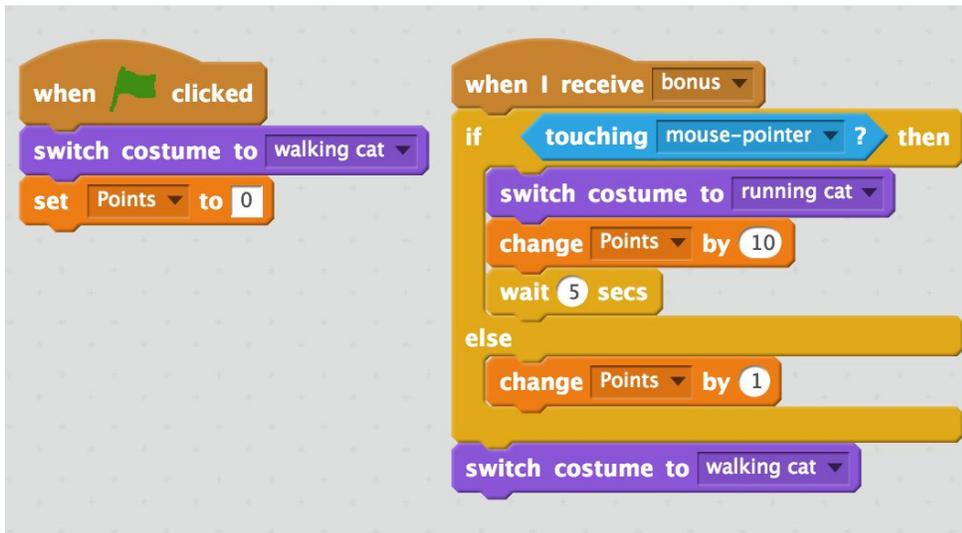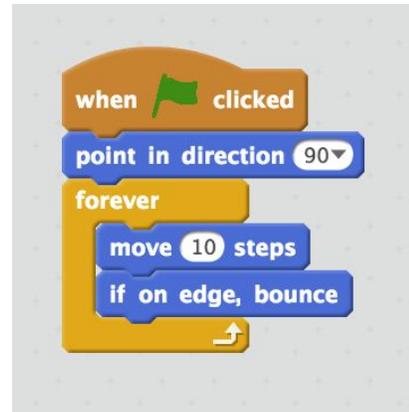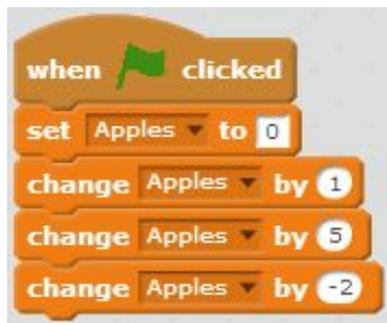
S3. (1 pt) When will the sprite wear the **running cat** costume?
- a) For the whole game
- b) When it receives the **bonus** message
- c) When it receives the **bonus** message and it's touching the mouse
- d) Not enough information
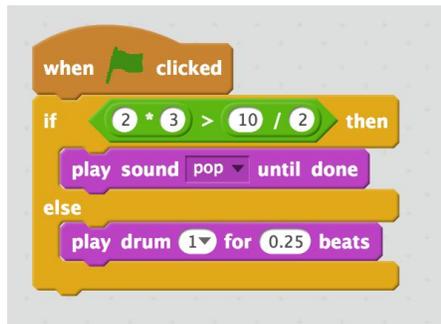
S4. (2 pts) What happens after the green flag is clicked?
- a) The sound **pop** plays
- b) The sound **meow** plays
- c) The **drum** plays for 0.25 beats
- d) Nothing

S5. (2 pts) What value is stored in **Apples** after this code runs?
- a) **Apples** = 0
- b) **Apples** = 4
- c) **Apples** = 8
- d) **Apples** = -10

S6. (3 pts) What values are stored in **Apples** and **Pears** after this code runs?
- a) **Apples** = 0, **Pears** = 10
- b) **Apples** = 5, **Pears** = 5
- c) **Apples** = 10, **Pears** = 5
- d) **Apples** = 15, **Pears** = 5

S7. (3 pts) How many clones will exist after 6 seconds?
a) 0
b) 1
c) 3
d) 7

S8. (4 pts) How many clones will exist after 20 seconds?
a) 0
b) 2
c) 6
d) 7

S9. (4 pts) What does the program above do?
a) Add item **zebra** to a list **zoo animals**
b) Remove all items called **zebra** from the list **zoo animals**
c) Remove one item called **zebra** from the list **zoo animals**
d) Make a list of **zoo animals**

S10. (4 pts) Which of the above will simulate gravity in a game? The sprite should jump up when the space key is pressed and then fall back down until it hits the gray ground. The sprite should not be able to double jump (jump when it is still in the air).

    a) Only 1
    b) Only 2
    c) 1 and 2
    d) 2 and 3
    e) 1, 2, and 3

Section 2: Pseudocode Questions

```
When green button is pushed:
      Robot wakes up
When red button is pushed:
      Robot sleeps
```

P1. (1 pt) What happens when Taylor pushes the green button?

    a) The robot wakes up
    b) The robot falls asleep
    c) The robot wakes up and then falls asleep
    d) Nothing

```
If Eduardo takes the train AND the bus to work:
        He spends $10
Else if Eduardo takes the train OR the bus to work:
        He spends $5
Else
        He spends $1
```

P2. (1 pt) Eduardo takes the bus to work. How much does he spend?
   a) $10
   b) $5
   c) $1
   d) $0

P3. (1 pt) Eduardo takes a hang glider to work. How much does he spend?
   a) $10
   b) $5
   c) $1
   d) $0

P4. (1 pt) Eduardo takes the bus and the train to work. How much does he spend?
   a) $16
   b) $15
   c) $10
   d) $5

```
set LIVES to 0
repeat 3 times:
        change LIVES by 4
divide LIVES by 2
```

P5. (2 pts) What value is stored in **LIVES** after this code runs?
   a) 0
   b) 2
   c) 4
   d) 6

```
set J to 1
set K to 7
while J is less than K:
        if K is odd:
                Set J to J * 3
                Change K by 1
        else:
                Change K by -2
```

P6. (3 pts) What values are stored in J and K after the code above runs?
   a) J = 3, K = 2
   b) J = 2, K = 3
   c) J = 9, K = 9
   d) J = 27, K = 4

A **function** takes some number as an **input** and gives you back, or **returns,** some other number, called an **output**. We can write this process as *FunctionName(***input***)* = **output**. For example, if *MysteryFun* adds 2 to every input, we would have *MysteryFun*(3) = 3 + 2 = 5.

Yadu has a function called *MysteryFun,* but can't remember what it does. He tries 0, 2, and 8 as inputs and gets the following outputs:
```
MysteryFun(0) = 0
MysteryFun(2) = 4
MysteryFun(8) = 64
```

P7. (2 pts) What will Yadu see if he types *MysteryFun*(6)?
   a) 3
   b) 6
   c) 9
   d) 36

P8. (2 pts) What will Yadu see if he types *MysteryFun*(-2)?
   a) Does not exist
   b) -2
   c) 2
   d) 4

P9. (2 pts) Yadu gets 9 as an output from *MysteryFun*. What could have been the input?
   a) 0
   b) 3
   c) 9
   d) 81

Use the examples of `helper_method` **to answer the following questions.**

```
helper_method("hi" "bye" 1) = "hibye "
helper_method("zig" "zag" 2) = "zigzag zigzag "
helper_method("." "[] []" 4) = ".[] [] .[] [] .[] [] .[] [] "
```

P10. (3 pts) What does `helper_method("a" "b" 3)` equal?
a) "ababab"
b) "ab ab ab "
c) "a b a b a b "
d) "aaa bbb "

P11. (3 pts) The pseudocode for helper_method contains an error! Which two lines should be swapped to make it correct?

```
1      S1 = first input
2      S2 = second input
3      N = third input
4      RESULT = ""
5      repeat N times:
6            add S1 to RESULT
7            add " " to RESULT
8            add S2 to RESULT
9      return RESULT
```

a) 1 and 2
b) 3 and 4
c) 6 and 7
d) 7 and 8

```
set COUNT to 1
repeat 3 times:
      add 1 to COUNT
      repeat COUNT times:
            print the letter Q
      print a space
```

P12. (4 pts) What will the program above print?
a) QQ Q Q
b) Q QQ QQQ
c) QQ QQQ QQQQ
d) QQQ QQQ QQQ QQQ QQQ QQQ QQQ QQQ QQQ

An **array** is a data structure which stores items, or **values**, in a certain order. To save an array called a1 containing apple, pear, and banana, we would write the following:

```
Array a1 = ["apple", "pear", "banana"]
```

We can find a value by using the **name of the array** and the value's **position** to get that value back. You are probably used to counting starting with 1, but here we start with 0! For example:

```
a1[0] ---> "apple"
a1[1] ---> "pear"
a1[2] ---> "banana"

Array a2 = [3, 7, 8, 5, 7, 9]
```

P13. (2 pts) How could you get 7 from the array above?
   a) a2[7]
   b) a7[1]
   c) a2[1]
   d) A2[4]

P14. (2 pts) What will a2[5] return?
   a) 5
   b) 7
   c) 8
   d) 9

```
fun_1(input) = input - 1
fun_2(input) = input x 2
F(input_1, input_2) = fun_1(input_1) + fun_2(input_2) + 1
```
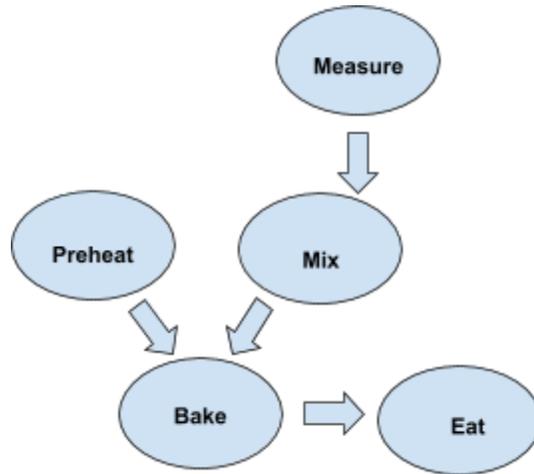
P15. (4 pts) What is F(6, 5)?
   a) 11
   b) 12
   c) 16
   d) 17

A **directed graph** is a data structure that keeps track of steps in a process, and which steps depend on each other. For example, if Nathan has a recipe to make cookies:

Nathan's Cookie Recipe
1. **Preheat** oven to 325°F.
2. **Measure** ingredients.
3. **Mix** ingredients together.
4. **Bake** dough at 325°F for 6 minutes.
5. **Eat** cookies!

These steps don't *all* need to happen in the order shown. On the right is the **graph** of the recipe. The ways the arrows point show which steps have to happen before others - for example, I can't bake the cookies if haven't preheated the oven, or they will just stay cookie dough!

P16. (3 pts) Based on the graph above, what does Nathan have to do before he mixes the ingredients?
   a) Measure
   b) Preheat
   c) Preheat and measure
   d) Eat the cookies
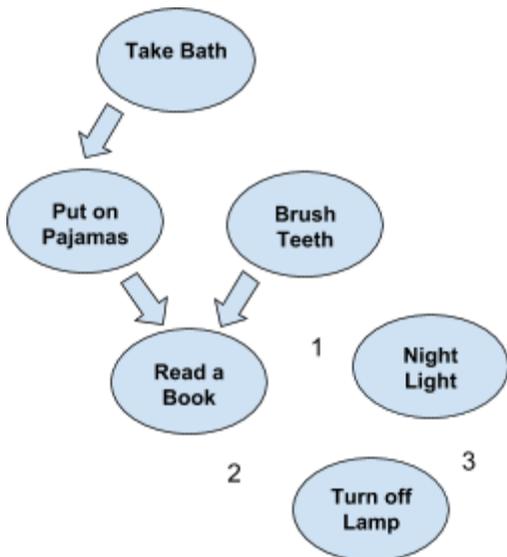
P17. (3 pts) The graph on the left shows Benedict's bedtime routine. What does he have to do before he reads a book?
   a) Put on pajamas
   b) Put on pajamas or brush his teeth
   c) Take a bath, put on pajamas and brush his teeth
   d) Nothing

P18. (4 pts) After he reads a funny book, Benedict turns off the lamp and goes to sleep. But when he reads a book about monsters, he gets scared, so he turns on his night light before turning off the lamp. Where would you draw arrows to complete the graph?
   a) Only 1 and 3
   b) Only 1 and 2
   c) Only 2 and 3
   d) 1, 2, and 3

A **map** is a data structure that uses **keywords** to keep track of information related to those keywords. Here is an example of a map of people and their friends:

```
(Rayid : {Matt, Renata, Joe, Demond, Amarria}
 Renata : {Rayid, Joe}
 Matt : {Demond, Joe, Bridgit}
 Joe : {Rayid, Renata, Matt}
 Demond : {Rayid, Matt}
 Amarria : {Rayid}
 Bridgit : {Matt})
```

From this map, we know that Rayid is friends with Matt, Renata, Joe, Demond, and Amarria. To get from Rayid to Bridgit takes two steps, because Rayid is friends with Matt, and Matt is friends with Bridgit.

P19. (3 pts) Who is friends with Renata?
   a) Amarria
   b) Rayid
   c) Demond
   d) Bridgit

P20. (4 pts) What is the smallest number of steps to get from Bridgit to Amarria? _____

Section 3: Logic Questions

L1. (1 pt) Andrea loves dogs. Everyone who loves dogs wears purple shoes at school. Andrea is at school. What color are Andrea's shoes?
   a) pink
   b) blue
   c) green
   d) purple

L2. (1 pt) Martín always goes to the fishmonger on Sundays. Martín always watches wrestling on Thursdays. Virinchi does what Martín does on Martín's birthday. Today is Martín's birthday. Today is Thursday. What is Virinchi doing today?
   a) going to the fishmonger
   b) watching wrestling
   c) eating birthday cake
   d) not enough information

L3. (1 pt) Shiraz is a soccer player. James is silly. Only soccer players are silly.

All soccer players like cupcakes. Who likes cupcakes?
   a) Only Shiraz
   b) Only James
   c) Both Shiraz and James
   d) Not enough information

L4. (2 pts) Yusuf goes outside if the sun is shining and he is not hungry. Otherwise, he stays inside. Yusuf plays chess if he has at least $400 in his bank account. Otherwise, he plays checkers. The sun is shining, Yusuf is hungry, and he has $450 in his bank account. What does Yusuf do?
   a) Yusuf plays chess outside.
   b) Yusuf plays chess inside.
   c) Yusuf plays checkers outside.
   d) Yusuf plays checkers inside.

L5. (3 pts) 97 baseball teams participate in an annual state tournament. The champion is chosen for this tournament by the following scheme: the 97 teams are divided into pairs, and the two teams of each pair play against each other. The loser of each pair is eliminated, and the remaining teams are paired up again. How many games must be played to determine a champion?
   a) 49
   b) 93
   c) 97
   d) 194

Eamon keeps forgetting things, but luckily, he has a computer. Computers are really good at remembering things, but he wants to use the right data structure for each job. He has three data structures to choose from:
   ● **Stack -** It is very fast to put data into a stack, but to retrieve something you have to remove everything on top of it, so it is slow to get data out.
   ● **Set -** Sets keep track of values, without any order. It is very fast to tell whether a certain value is in a set.
   ● **Map -** Maps keep track of keywords and any information you want to remember that goes along with those keywords.

L6. (2 pts) Which data structure should Eamon use to store all of the websites he has visited? He goes to new sites all the time, but he almost never goes back to the same website twice.
   a) Stack
   a) Set
   b) Map

L7. (2 pts) Eamon likes to write letters to his friends, but has a hard time remembering all of their addresses. Which data structure should Eamon use to store his friends and their addresses?

a) Stack
b) Set
c) Map

L8. (2 pts) Which data structure should Eamon use to store gluten-free foods? He will need to know quickly whether or not a food is gluten-free.
a) Stack
b) Set
c) Map

L9. (3 pts) Pascale's piggybank contains 2 quarters, 3 dimes, 1 nickel, and 4 pennies. She takes out one coin at random. What are the chances the coin is a dime **or** a nickel?
a) 1/10
b) 3/10
c) 4/10
d) 1/2

L10. (4 pts) Pascale puts the first coin back in the piggybank and draws two more. What are the chances the coins add up to 35 cents or more? (Quarters are 25 cents, dimes are 10 cents, nickels are 5 cents, and pennies are 1 cent).
a) 1/2
b) 6/10
c) 14/90
d) 35/90

L11. (4 pts) Sasha has 8 marbles and an old-fashioned scale. The marbles are all identical, except that one is heavier than the rest. What is the minimum number of steps Sasha could take to identify the heavier marble?

a) 2
b) 3
c) 4
d) 8

BONUS Questions

B1. (1 pt.) What is the Internet?
   a) The World Wide Web
   b) A network of networks
   c) A network protocol
   d) A physical connection between computers

B2.(1 pt.) What is Cloud Computing?
   a) Computing while traveling in a plane
   b) Using remote computers for computing and processing data
   c) A type of computer program
   d) Computing on the go

B3. (1 pt.) Who was Alan Turing?
   a) A medical doctor
   b) A rock star
   c) A pioneering computer scientist
   d) A character in a movie

B4 (1 pt.) Who was the first computer programmer?
   a) Bill Gates
   b) Steve Jobs
   c) Ada Lovelace
   d) Mark Zuckerberg

B5. (1 pt.) How many bits are there in a Byte?
   a) 4
   b) 8
   c) 16
   d) There is no relationship between a bit and a byte