WASHINGTON STATE MIDDLE SCHOOL COMPUTER SCIENCE COMPETITION 2019

Individual Challenge
Grades 5 – 6
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 questions, please raise your hand.

➤ No electronic devices of any kind (phones, computers, etc.) are allowed during the test.

➤ All questions are multiple choice questions. Mark all answers on the answer sheet provided. Mark as clearly as possible. The answer sheet is graded by an automated machine. If the machine is not able to read your answers, you will not receive points.

➤ There are three sections to this test; Scratch (question 1 - 10), Pseudocode (question 11 - 25), and Logic and Math (questions 26 - 32).

➤ Every question is worth 1 point. Some questions are more difficult than others. If you perceive a question to be difficult or is taking longer to solve, we recommend that you move on to the next question and come back to it if you have time. Questions within each section approximately increase in difficulty.

➤ 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!

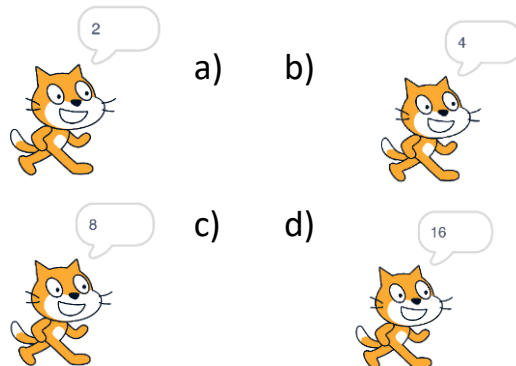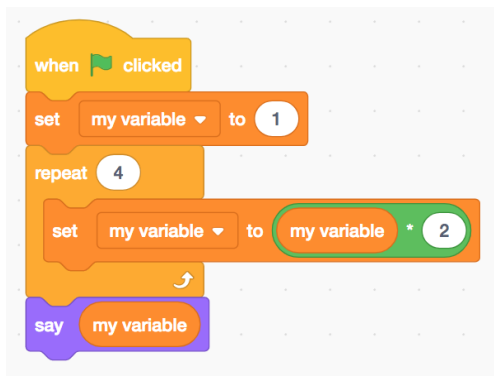➤ There are Bonus Questions worth 1 point each at the end of this test.

Scratch Questions
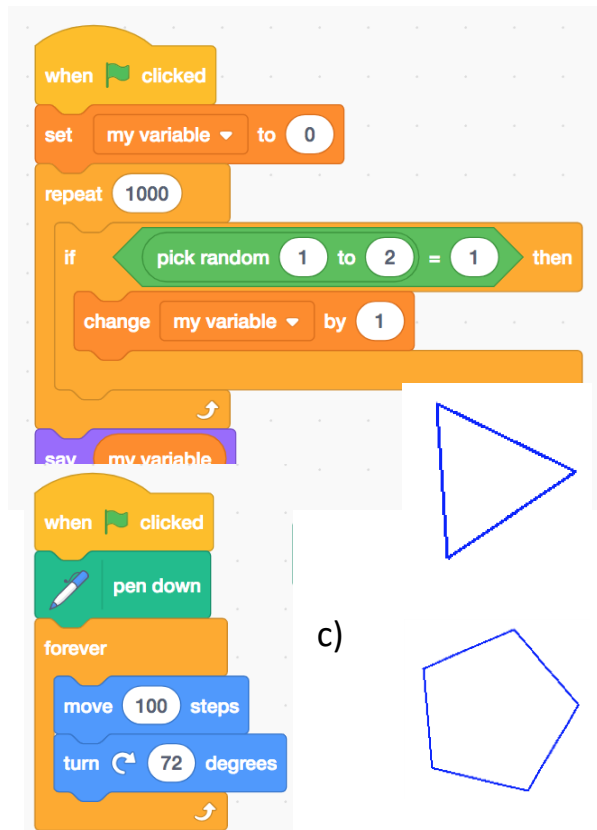
Match the output to the program.
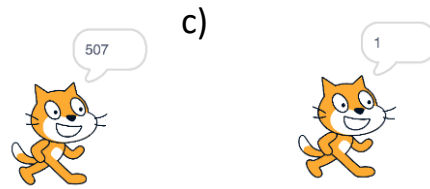
1.

a) b)

c) d)

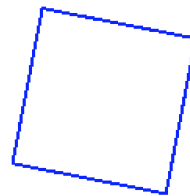2.

a) b)

c) d)
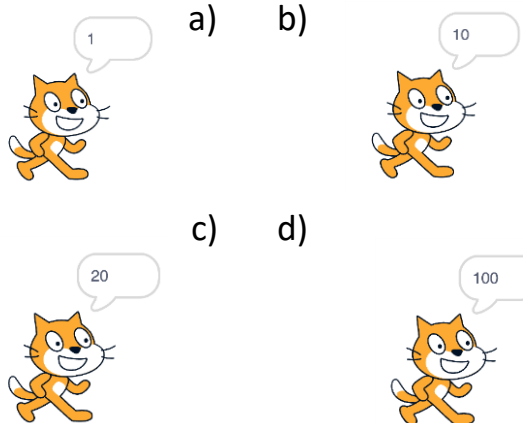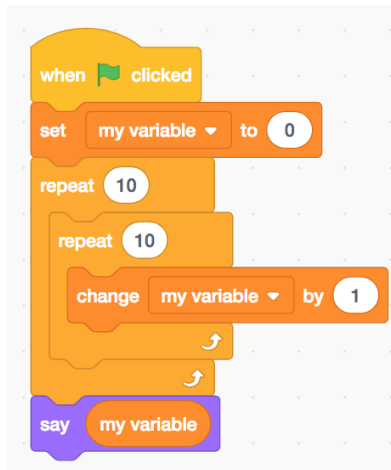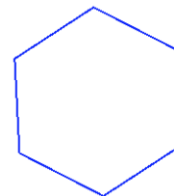
3. (select the most likely answer)
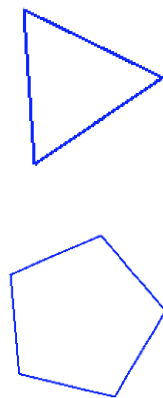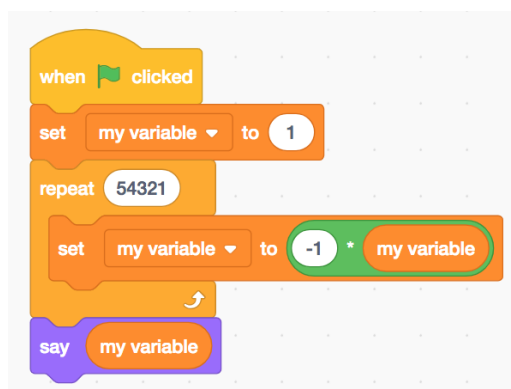
a)   b)

c)   d)

4.

a)   b)

c)   d)

5)

a)   b)

c)   d)

6)

a) my variable `0`

b) my variable `1`

c) my variable `8`

d) my variable `16`

7)
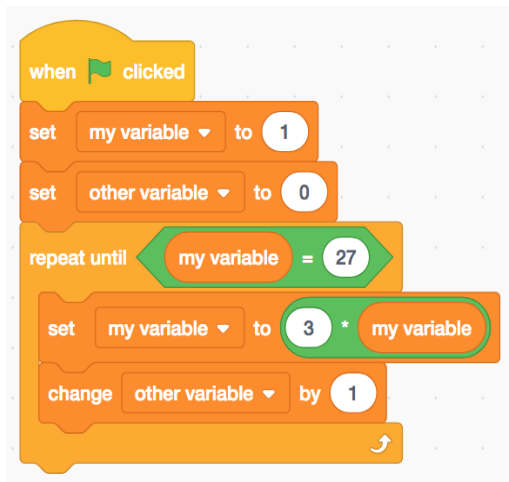
a) my variable `27`
other variable `2`

b) my variable `27`
other variable `3`

c) my variable `27`
other variable `4`

d) my variable `27`
other variable `5`

8)
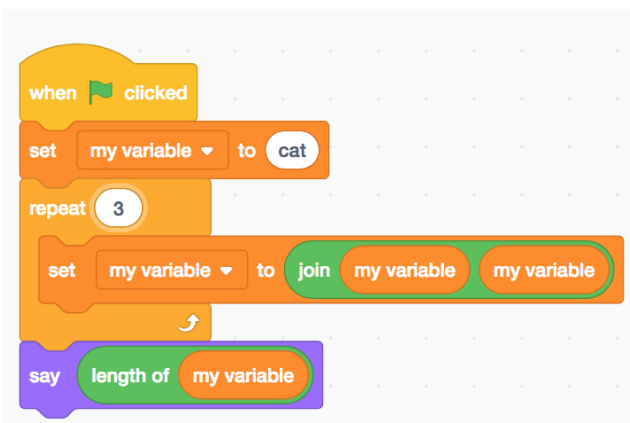
a) 24

b) catcatcat

c) 12

d) 9

9)

(hint : mod calculates the remainder after division → 11 mod 3 = 2, 9 mod 3 = 0)

```
when [flag] clicked
set [my variable ▼] to (0)
set [other variable ▼] to ( )
repeat (10)
    change [my variable ▼] by (1)
    set [other variable ▼] to (join (other variable) ((my variable) mod (2)))
say (other variable)
```

a)

b)

1201201201

c)   d)

1010101010
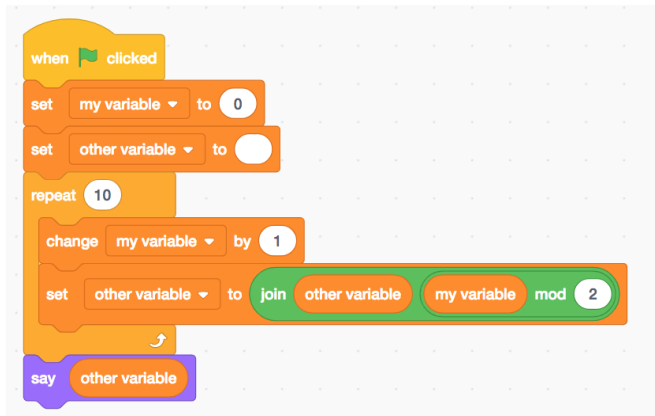
1212121212

10)
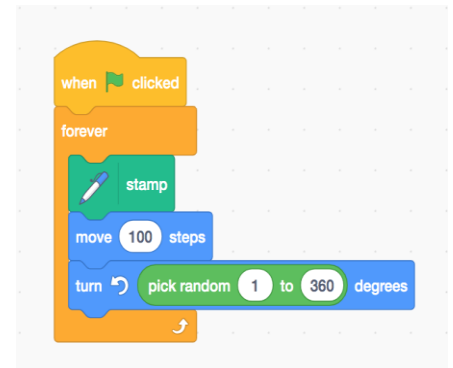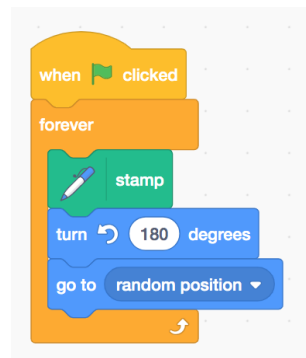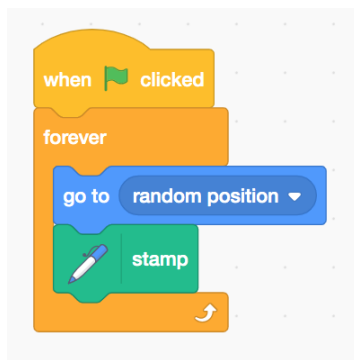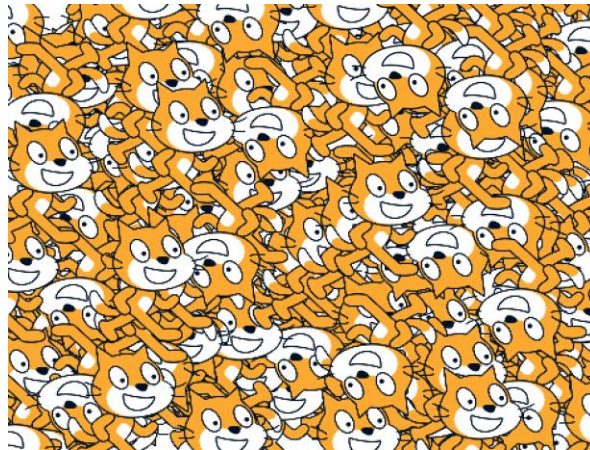
a) b) c)

Math and Logic

11)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)

0	1	1	2	3	5				What goes here?

a)

12

b)

34

a)

24

b)

72

12)

　　　$1 + 2 + 3 + 4 + 5 + \ldots + \ldots + 95 + 96 + 97 + 98 + 99 + 100$

a) 550

b) 5000

c) 5050

d) 10100

13)

　　　hint: $a^b = c$ → $\log_a c = b$

　　　What is x if $\log_2(x) = 32$

　　a) 5　　　　b) 64　　　　c) 16　　　d) 2

14)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2	3	5	7	11	13				What goes

									here?

a)

30

b)

21

c)

29

d)

25

15)

$$\frac{1 * 2 * 3 * \ldots * 98 * 99 * 100}{2 * 3 * 4 * \ldots * 97 * 98 * 99}$$

a) 100   b) 1,562,322,651   c) 1.11111   d) 0.99999

16)

$$\frac{1 + 2 + 3 + \ldots + infinity}{-1 - 2 - 3 - \ldots - infinity}$$

a) 0   b) infinity   c) -infinity   d) -1

17)   Which is largest?

a) 10^2 b) 10 * 10   c) $\dfrac{1}{10^{-3}}$ d) 101

18)

$$\dfrac{99^{102}}{99^{100}}$$

a) 99   b) 198   c) 9801   d) 8910

19) *hint : 4! = 1*2*3*4*

$$\dfrac{101!}{99!}$$

a) 101   b) 198,100   c) 99,010   d) 10,100

20)
Two planes, 100 miles apart, are on a crash course. They are both traveling at 200 mph towards each other. Superman can fly 1000 mph. How far away from the crash location is superman if he can still prevent the crash right before it happens?

a) 200 miles   b) 250 miles   c) 500 miles   d) 750 miles

Pseudocode

Pseudocode is code that communicates computational ideas, but doesn't actually run on a computer.

21)
```
x = 0
y = 1
repeat (3) :
    x = x + y
    y = y * 2
```

a) x = 6   **b)** x = 7   **c)** y = 16   **d)** y = 4

22) *(hint : an array is a list of values that can be accessed by an index number)*

```
myArray = [1,2,3,4,5]
print myArray[0]
```
→ 1
```
print myArray[ length (myArray) - 1]
```
→ 5

print myArray [length (myArray) - 4]

a) → 1   b) → 2   c) → 3   d) → 4

23)

Modulus, denoted "%" is a mathematical operator like *, +, /, -. Modulus gives the remainder after division. For example, 7/3 = 2, remainder 1; so 7%3 = 1.

If the following is true about x, what is the value of x?
x % 5 = 1
24 % x = 0

a) x = 5   b) x = 24   c) x = 8   d) x = 6

24) *hint : a 2D array is an array of arrays.*
```
my2DArray = [
                [1,   2,   3,   4],
                [5,   6,   7,   8],
                [9, 10, 12, 45]
                ]
my2DArray[0][0] = 1
my2DArray[2][1] = 10
my2DArray[1][3] = 8
my2DArray[1][2] = ??
```

a) 7   b) 10   c) 6   d) 3

25)   *(hint : a function is some code that can return a value based on an input)*
magicFunction (3, 5) → 2
magicFunction (-1, 20) → 21
magicFunction (100, 12) → -88

a) magicFunction (x, y) → x + y
b) magicFunction (x, y) → x - y
c) magicFunction (x, y) → y - x
d) magicFunction (x, y) → x % y
26)

```
myFunction ( x ) :
    print x
    if x is not zero :
        myFunction ( x - 1)

myFunction ( 3 )
```

a) → 0 1 2 3   b) → 3 2 1   c) → 1 2 3   d) → 3 2 1 0

27)

myFunction (x) → x + x

```
x = 1
repeat (5) :
    x = myFunction (x)
print x
```

a) → 5   b) → 15   c) → 16   d) → 32

28)

magicFunction ("cat") → "tac"

magicFunction ("apple) → "eppla"

magicFunction ("human") → ???

a) → "human"   b) → "manhu"   c) → "namuh"   d) → "numah"

29)

Which arrangement of the following operations will result in the largest number
when x starts as one million?

1. $x \rightarrow x + x$
2. $x \rightarrow x * x$
3. $x \rightarrow x + 1$

a) $1 \rightarrow 2 \rightarrow 3$ b) $3 \rightarrow 2 \rightarrow 1$ c) $3 \rightarrow 1 \rightarrow 2$ d) $2 \rightarrow 1 \rightarrow 3$
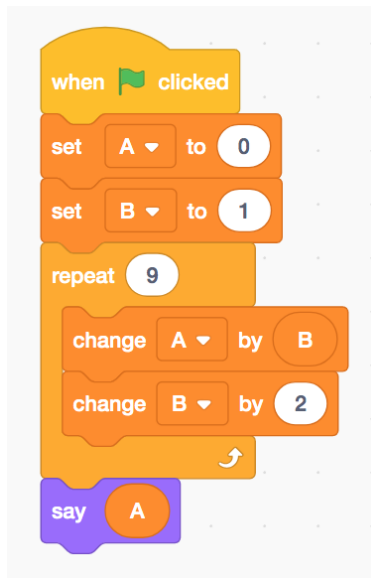
30)
    129   %   25 $\rightarrow$??

a) 5   b)   4   c) 9   d)   125

Bonus

31)

a)   b)   c)   d)

32)   If 9! = 362,880, what is 10!

a) 362,890   b) 1,362,880   c) 3,628,800   d) 10,362,880

33)

Factorial is another mathematical operation denoted "!" which computes the product of all of the numbers from 1 to N, where N is the number before the "!".

For example :

4! = 4*3*2*1

Which of the following functions will calculate the factorial of n?

a)	b)	c)

Factorial (n) →
   a = 1
   b = n
   repeat (n) :
      b = b * a
      a = a -1
   print b
	Factorial (n) →
	   a = n
	   b = 1
	   repeat (n) :
	      b = b * a
	      a = a -1
	   print b
		Factorial (n) →
		   a = n
		   b = n
		   repeat (n) :
		      b = b * a
		      a = a -1
		   print b

34) Which of the following patterns corresponds to the encoding of DNA?

a) 10 01 11   b) 12 02 01   c) 010 001 111   d) 032 113 021