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ACSL

2018-2019 **All-Star Contest**

American Computer Science League

Junior Division

Instructions for Short Round Questions

1. **MATERIALS ALLOWED**
   - Plain paper and pencils
   - No calculators, cell phones, headphones or any type of electronic device
2. **SCORE SHEETS**
   - Use the blue side.
   - Use pencils only to mark the answers.
   - Put your name, school name, grade and division on the back of the scoresheet.
   - See the form example for marking the answers.
   - No erasures are allowed – use an additional score sheet if necessary.
   - There will be no appeals based upon answer sheet errors.
3. **STUDENT PROCEDURES**
   - Keep your eyes on your own paper.
   - Keep answer sheets and scrap paper guarded.
   - You must stay in the room until the end of the test.
   - You can keep all materials at the end.
   - The time limit is 45 minutes.
4. **TEST ANSWERS**
   - Proctors will read the letter answers at the end of the testing period.
   - Appeals in writing must be brought to the scoring room no later than 3:30 PM. The appeal must show your detailed solution.

1. Boolean Algebra

How many ordered triples make the following Boolean expression TRUE?

$$\overline{A\overline{B}}\ \overline{B+\overline{C}}\ \overline{\overline{A}(B+C)}$$

A. 0
B. 2
C. 4
D. 8
E. None of the above

2. Bit-String Flicking

Evaluate the following expression if **x** = 110101:

```
(LSHIFT-1 x) OR (RCIRC-2 x) AND (RSHIFT-3 x)
```

A. 000110
B. 111110
C. 101011
D. 101110
E. None of the above

3. Recursive Functions

Find $f(f(f(f(14))))$ given the function below:

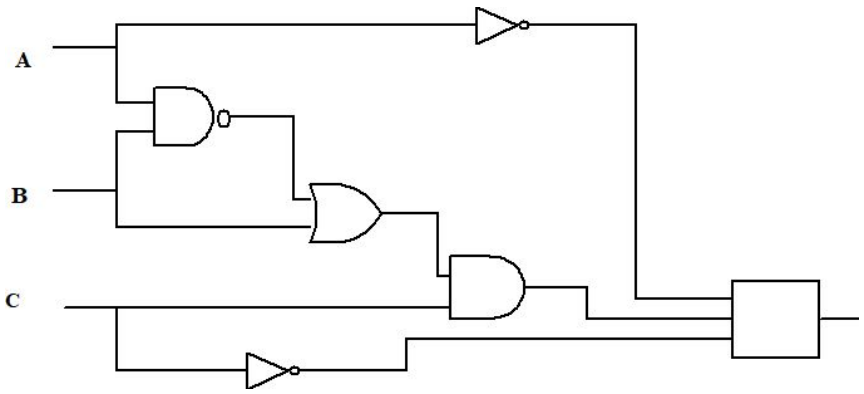
$$f(x) = \begin{cases} f(f(x-2)-2) & \text{if } x >= 12 \\ x+1 & \text{if } x < 12 \end{cases}$$

A. 9
B. 10
C. 11
D. 12
E. None of the above

4. Digital Electronics

In the circuit below, the rectangle represents a new type of logic gate: It accepts three inputs and has one output. The output is TRUE if and only if only 1 input is TRUE.

How many ordered triples make the circuit TRUE?



A. 0
B. 2
C. 4
D. 6
E. None of the above

5. Prefix-Infix-Postfix

Evaluate the following prefix expression (all numbers are single digits):

```
/ + ^ / + 4 6 - 7 5 2 * 7 - 5 4 ^ / + 1 7 - 5 1 4
```

A. 1
B. 2
C. 3
D. 4
E. None of the above

6. Computer Number Systems

How many times does the digit "2" appear when the numbers from 1978 (base 10) to 2019 (base 10), inclusive, are converted to octal?

A. 12
B. 13
C. 14
D. 15
E. None of the above

7. What Does This Program Do?

What is printed when this program is executed?

```
y = 0
for x = -4 to 4
  if x/2 == int(x/2) then
    y = y + x/2 - 1
  else
    if x > 0 then
      y = y + 2*(x - 3)
    else
      y = y + x*x-3
    end if
  end if
next x
output y
```

A. -6
B. -5
C. -3
D. -1
E. None of the above

8. Data Structures

Build a binary search tree from the following letters:

```
L I L Y O F T H E V A L L E Y
```

How many nodes have only a left child?

A. 1
B. 2
C. 4
D. 8
E. None of the above