



## American Computer Science League

2019-2020

Contest #3

### JUNIOR DIVISION

#### 1. Boolean Algebra

Simplify the following expression:

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

1.

#### 2. Boolean Algebra

Which ordered triples make the following FALSE?

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

2.

#### 3. Data Structures

What is the depth of the binary search tree for:

**THECONSTITUTIONSTATE**

3.

#### 4. Data Structures

Given an initially empty queue and the following commands on the queue, what will the next popped item be?

PUSH(L), PUSH(E), PUSH(S), POP(X), PUSH(M), PUSH(I),  
PUSH(S), POP(X), POP(X), PUSH(E), PUSH(R), PUSH(A),  
POP(X), POP(X), PUSH(B), PUSH(L), POP(X), POP(X), PUSH(E),  
POP(X), POP(X), PUSH(S).

4.



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#### 5. What Does This Program Do? - Arrays

What is outputted when this program is run?

```
for i = 1 to 5
  for j = 1 to 5
    a(i,j) = int((i + j) / 2)
  next j
next i
for i = 1 to 5
  for j = 1 to 5
    if a(i,j) / 2 == int(a(i,j) / 2) then
      a(i,j) = a(i,j) / 2
    else
      a(i,j) = 2 * a(i,j)
    end if
  next j
next i
for i = 1 to 5
  for j = 1 to 4
    if a(i,j) == a(i, j + 1) then
      a(i,j) = 0
    end if
  next j
next i
print a(1,5) + a(5,5)
end
```

5.



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#### 1. Boolean Algebra

简化下述表达式:

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

1.

#### 2. Boolean Algebra

哪个有序三元组使得下述表达式为假:

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

2.

#### 3. Data Structures

下述二叉搜索树的深度为:

THECONSTITUTIONSTATE

3.

#### 4. Data Structures

给定一个初始为空的队列和队列上的以下命令, 下一个弹出的项是什么?

PUSH(L), PUSH(E), PUSH(S), POP(X), PUSH(M), PUSH(I),  
PUSH(S), POP(X), POP(X), PUSH(E), PUSH(R), PUSH(A),  
POP(X), POP(X), PUSH(B), PUSH(L), POP(X), POP(X), PUSH(E),  
POP(X), POP(X), PUSH(S).

4.



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#### 5. What Does This Program Do? - Arrays

执行此程序时，会输出什么？

```
for i = 1 to 5
  for j = 1 to 5
    a(i,j) = int((i + j) / 2)
  next j
next i
for i = 1 to 5
  for j = 1 to 5
    if a(i,j) / 2 == int(a(i,j) / 2) then
      a(i,j) = a(i,j) / 2
    else
      a(i,j) = 2 * a(i,j)
    end if
  next j
next i
for i = 1 to 5
  for j = 1 to 4
    if a(i,j) == a(i, j + 1) then
      a(i,j) = 0
    end if
  next j
next i
print a(1,5) + a(5,5)
end
```

5.