

# American Computer Science League

2021-2022 • Contest 3: Short Problems • Junior Division

<b>1. Boolean Algebra</b>  Which ordered pair makes the following Boolean expression TRUE? $\bar{A} (AB + \bar{B})$	A. (0, 0) B. (0, 1) C. (1, 0) D. (1, 1) E. None of the above
<b>2. Boolean Algebra</b>  Simplify the following Boolean expression: $A (\bar{B} + \bar{C}) + \bar{A} B + \overline{BC}$	A. $\bar{A} + B + \bar{C}$ B. $B + \bar{A} C + \bar{C}$ C. $\bar{A} \bar{B} + B + \bar{C}$ D. $\bar{B} + \bar{C} + \bar{A} B$ E. $C + \bar{A} + \bar{B}$
<b>3. Data Structures</b>  What nodes (listed left to right) are at a depth of 3 in the binary search tree for: $\text{TOKYOOLYMPICS}$	A. S O I B. C O L C. I P S D. K P Y E. I O S
<b>4. Data Structures</b>  Given an initially empty queue and the following commands on the queue, what item will be popped next?  PUSH("A"), PUSH("Q"), PUSH("U"), X=POP( ), PUSH("A"), PUSH("R"), X=POP( ), X=POP( ), PUSH("T"), X=POP( ), PUSH("U"), PUSH("S")	A. A B. I C. R D. U E. S

---

**5. What Does This Program Do? (Arrays)**

After the following program is executed, how many elements in the array are not zero?

```
for i = 0 to 3
  for j = 0 to 3
    a(i,j) = 2 * i + 3 * j
  next j
next i
for i = 0 to 3
  for j = 0 to 3
    if a(i,j) >= 10 then
      a(i,j) = a(i,j) - 10
    end if
    if a(i,j) < 6 then
      a(i,j) = 0
    end if
  next j
next i
```

- A. 0
- B. 4
- C. 6
- D. 10
- E. 16

---