

# American Computer Science League

2021-2022 • Contest 3: Short Problems Solutions • Intermediate Division

## 1. Boolean Algebra

$$\begin{aligned}\overline{A\overline{B}} + \overline{\overline{A}B\overline{C}} + \overline{\overline{B}C} &= (\overline{A} + B) + (A + \overline{B} + C) + (B + \overline{C}) \\ &= (A + \overline{A}) + (B + \overline{B}) + (C + \overline{C}) \\ &= 1\end{aligned}$$

B. 1

## 2. Boolean Algebra

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

If  $A = 1$ , then  $\overline{B} + 0 + 0 = 1$  So  $\overline{B} = 1$  (1, 0, \*) makes it TRUE

If  $A = 0$ , then  $0 + B + \overline{C} = 1$

If  $B = 1$ , then  $C = *$  (0, 1, \*) makes it TRUE

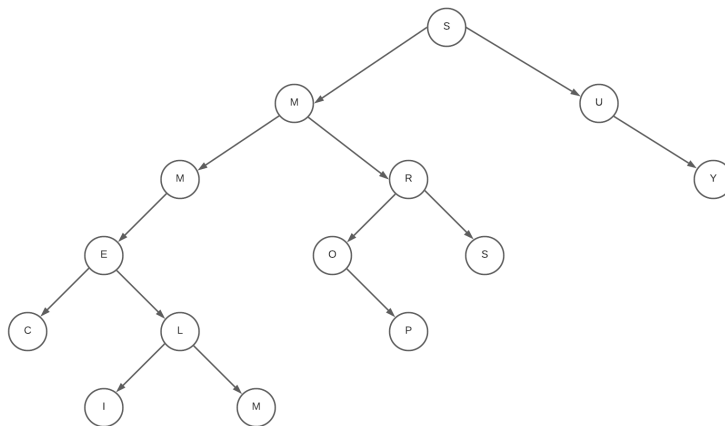
If  $B = 0$ , then  $0 + 0 + \overline{C} = 1$  (0, 0, 0) makes it TRUE

Therefore, 5 ordered triples make it TRUE.

C. 5

## 3. Data Structures

The binary search tree for SUMMEROLYMPICS is:



Only 2 nodes have only a right child: O and U

C. 2

---

#### 4. Data Structures

The stack is constructed using LIFO as follows:

C, CA, CAN, CA, C, CI, C, CS, CSM, CS, C, CA,  
CAJ, CA, CAO, CA, CAR, CA

The next item popped would be: A

E. A

---

#### 5. FSAs and Regular Expressions

1-321-[^05][0-9][^5]-[12][3-6][^7-9]8-[^0][2-6]

- a. 1-321-123-2348-11 Fails at 5th 1
- b. 1-321-155-2368-96 Fails at 2nd 5
- c. 1-321-444-2448-44 Valid
- d. 1-321-927-2408-84 Valid
- e. 1-321-559-2328-13 Fails at 1st 5
- f. 1-321-306-1366-62 Fails at 3rd 6

D. c, d

---