

SENIOR DIVISION SOLUTIONS

1. Boolean Algebra

1. 0

$$\begin{aligned}
 (A+B)(\overline{AB})(\overline{A+B})(\overline{AB}) &= (A+B)(\overline{A+B})(\overline{A+B})(A+\overline{B}) \\
 &= (\overline{AB} + \overline{AB})(\overline{AB} + \overline{AB}) \\
 &= \overline{ABAB} + \overline{ABAB} + \overline{ABAB} + \overline{ABAB} \\
 &= 0
 \end{aligned}$$

2. Boolean Algebra

2. 4

$$\begin{aligned}
 \overline{A(B+C)} + \overline{AB}(A+\overline{C}) + \overline{A+B+C} &= \overline{ABC} + (\overline{A+B})(A+\overline{C}) + \overline{ABC} \\
 &= \overline{ABC} + \overline{AA} + \overline{AC} + \overline{AB} + \overline{BC} \\
 &= \overline{BC}(\overline{A}+1) + \overline{AC} + \overline{AB} \\
 &= \overline{BC} + \overline{AC} + \overline{AB}
 \end{aligned}$$

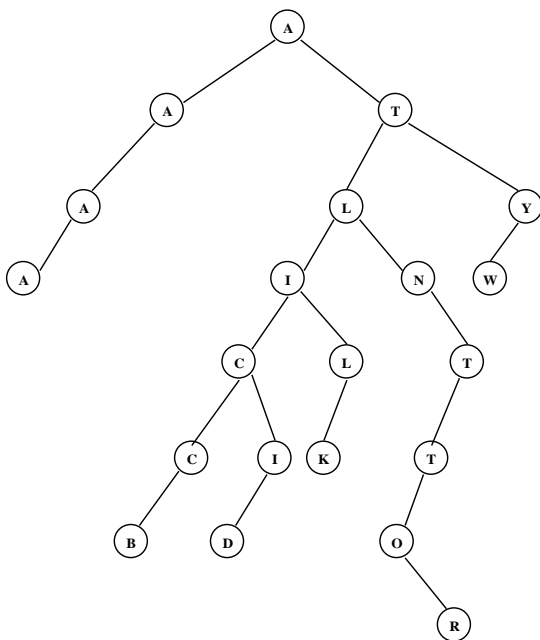
To make the expression FALSE $\overline{BC} = 0 \wedge \overline{AC} = 0 \wedge \overline{AB} = 0$

If $A=1$, then $\overline{BC} = 0 \wedge 0\overline{C} = 0 \wedge \overline{B} = 0 \rightarrow B=1 \wedge C=* \quad (1, 1, *)$ works.

If $A=0$, then $\overline{BC} = 0 \wedge \overline{C} = 0 \wedge 0\overline{B} = 0 \rightarrow C=1 \wedge B=* \quad (0, *, 1)$ works

3. Data Structures

3. 77



The internal path length is:

$$\begin{aligned}
 &2*1 + 3*2 + 4*3 + 3*4 \\
 &+ 4*5 + 3*6 + 1*7 = 2 \\
 &+ 6 + 12 + 12 + 20 + \\
 &18 + 7 = 77
 \end{aligned}$$

American Computer Science League

2018-2019

Contest #3

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4. Data Structures

The queue is constructed using FIFO as follows: C, CA, CAR, AR, RA, RAV, RAVA, RAVAN, AVAN, NAVA, AVA, AVAC, AVACY, AVACYC, AVACYCL, AVACYCLE, VACYCLE, ELCYCAV, LCYCAV, CYCAV, VACYC, ACYC, ACYCT, ACYCTR, ACYCTRU, ACYCTRUC, ACYCTRUCK, KCURTCYCA, CURTCYCA, URTCYCA, ACYCTRU, CYCTRU, URTCYC, RTCYC, CYCTR

4. C

5. FSA/Regular Expressions

The FSA translates to: $10^*1(101^*1 \cup 10^*1)0^*0$.

5. $10^*1(101^*1 \cup 10^*1)0^*0$