ACSL

American Computer Science League

2019-2020 — **Contest #3**

JUNIOR DIVISION SOLUTIONS

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1. Boolean Algebra

$$
\begin{aligned}
&A(\overline{AB}) + \overline{A}\left(\overline{A+B}\right) + A + \overline{B} \\
&= A(\overline{A} + \overline{B}) + \overline{A}\,\overline{A}\,\overline{B} + A + \overline{B} \\
&= A\overline{A} + A\overline{B} + \overline{A}\,\overline{B} + A + \overline{B} \\
&= 0 + A(\overline{B} + 1) + \overline{B}(\overline{A} + 1) \\
&= A + \overline{B}
\end{aligned}
$$

1. $A + \overline{B}$

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2. Boolean Algebra

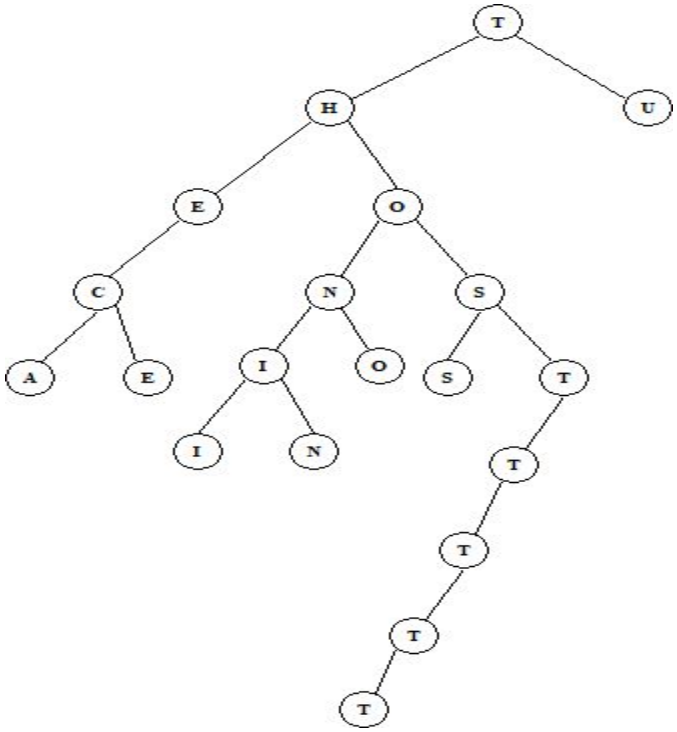
$$
\begin{aligned}
&\overline{A\,B\,C} + A\,\overline{B}\,C + \overline{A\,B\,\overline{C}} \\
&= \left(\overline{A} + \overline{B}\right)C + A\,\overline{B}\,C + \overline{A} + \overline{B} + C \\
&= \overline{A}\,C + \overline{B}\,C + A\,\overline{B}\,C + \overline{A} + \overline{B} + C \\
&= \overline{B}(C + A\,C + 1) + \overline{A}(C + 1) + C \\
&= \overline{B} + \overline{A} + C \\
&\overline{A} + \overline{B} + C = 0 \rightarrow \overline{A} = 0 \ \wedge\ \overline{B} = 0 \wedge\ C = 0 \\
&\qquad \rightarrow A = 1,\ B = 1,\ C = 0 \rightarrow (1,\ 1,\ 0)
\end{aligned}
$$

2. (1, 1, 0)

3. Data Structures

The depth of the tree for THECONSTITUTIONSTATE is 8.

The binary search tree is:



3. 8

4. Data Structures

The queue is constructed using FIFO as follows:

L, LE, LES, ES, ESM, ESMI, ESMIS, SMIS, MIS, MISE,

MISER, MISERA, ISERA, SERA, SERAB, SERABL,

ERABL, RABL, RABLE, ABLE, BLE, BLES

The next item popped would be B.

4. B

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5. What Does This Program Do? - Arrays

Array formed by first nested loop:

1	1	2	2	3
1	2	2	3	3
2	2	3	3	4
2	3	3	4	4
3	3	4	4	5

Array from 2nd nested loop:

2	2	1	1	6
2	1	1	6	6
1	1	6	6	2
1	6	6	2	2
6	6	2	2	10

Array from 3rd nested loop:

0	2	0	1
2	0	1	0
0	1	0	6
1	0	6	0
0	6	0	2

a(1,5) + a(5,5) = 6 + 10 = 16

5. 16