SENIOR DIVISION SOLUTIONS

---

1. Boolean Algebra

$$(A+B)(\overline{AB})(\overline{A}+B)(\overline{\overline{AB}}) = (A+B)(\overline{A}+\overline{B})(\overline{A}+B)(A+\overline{B})$$
$$= (\overline{A}B+A\overline{B})(AB+\overline{A}\,\overline{B})$$
$$= \overline{A}BAB+\overline{A}B\overline{A}\,\overline{B}+A\overline{B}AB+A\overline{B}\,\overline{A}\,\overline{B}$$
$$= 0$$

1. 0

---

2. Boolean Algebra

$$\overline{A}(\overline{B+C})+\overline{AB}(A+\overline{C})+\overline{A+B+C} = \overline{A}\,\overline{B}\,\overline{C}+(\overline{A}+\overline{B})(A+\overline{C})+\overline{A}\,\overline{B}\,\overline{C}$$
$$= \overline{A}\,\overline{B}\,\overline{C}+A\overline{A}+\overline{A}\,\overline{C}+A\overline{B}+\overline{B}\,\overline{C}$$
$$= \overline{B}\,\overline{C}(\overline{A}+1)+\overline{A}\,\overline{C}+A\overline{B}$$
$$= \overline{B}\,\overline{C}+\overline{A}\,\overline{C}+A\overline{B}$$

To make the expression FALSE $\overline{B}\,\overline{C}=0\wedge\overline{A}\,\overline{C}=0\wedge A\overline{B}=0$

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

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

2. 4

---
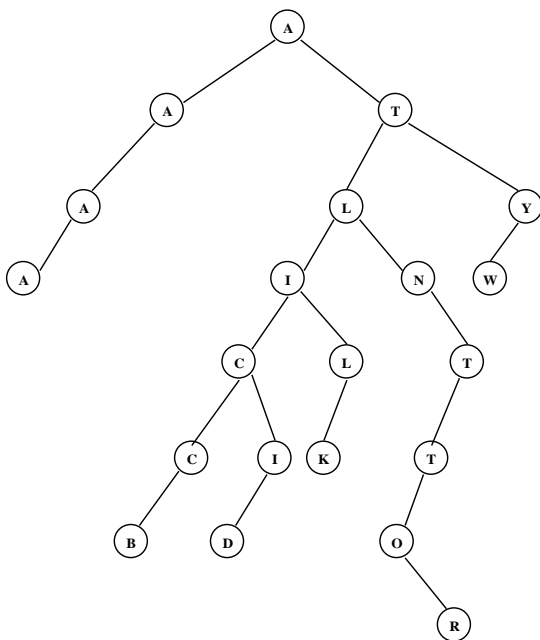
3. Data Structures

The internal path length is:
2*1 + 3*2 + 4*3 + 3*4 + 4*5 + 3*6 + 1*7 = 2 + 6 + 12 + 12 + 20 + 18 + 7 = 77

3. 77

SENIOR DIVISION SOLUTIONS

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