

1. Boolean Algebra

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

So $\overline{A} = 1$. $A = 0$. Therefore (0, 1) and (0, 0) make it true.

1. (0,1) and (0, 0)

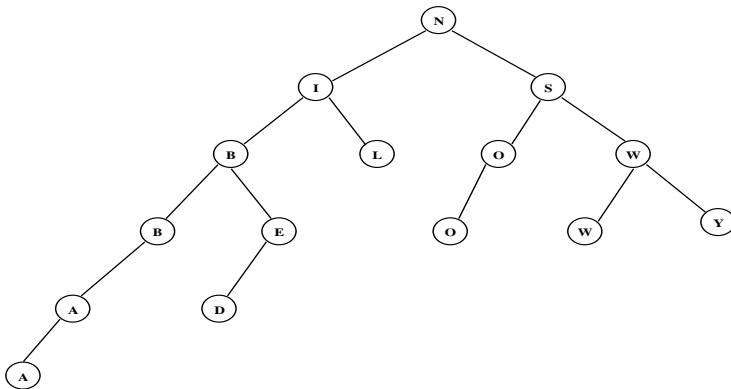
2. Boolean Algebra

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

2. A

3. Data Structures

Nibbles Wood Away is the name of the Big Blue Bug that is a Rhode Island icon atop a building in Providence.



3. A, B, E, O

4. Data Structures

The queue is constructed using FIFO as follows: O, OC, OCE, CE, CEA, CEAN, EAN, AN, ANS, ANST, NST, NSTA, NSTAT, NSTATE, STATE, TATE. The next item popped is T.

4. T

5. What Does This Program Do? - Arrays

After the first nested loop is executed, the array is at the right.

3	5	7	9
5	8	11	14
7	11	15	19
9	14	19	24

The second nested loop sets multiples of 2 or 3 or 5 equal to 0. Only prime numbers are left. The largest prime is 19 and the smallest is 7. The positive difference is 12.

5. 12

6. Boolean Algebra

$$\begin{aligned}
 A(A + \bar{B}) + \bar{A}\bar{B}(A + B) &= AA + A\bar{B} + (\bar{A} + \bar{B})(\bar{A} + B) \\
 &= A + A\bar{B} + \bar{A}\bar{A} + \bar{A}B + \bar{A}\bar{B} + \bar{B}B \\
 &= A + A\bar{B} + \bar{A} + \bar{A}B + \bar{A}\bar{B} \\
 &= A(1 + \bar{B}) + \bar{A}(1 + B + \bar{B}) = A + \bar{A} = 1
 \end{aligned}$$

6. 1

7. Boolean Algebra

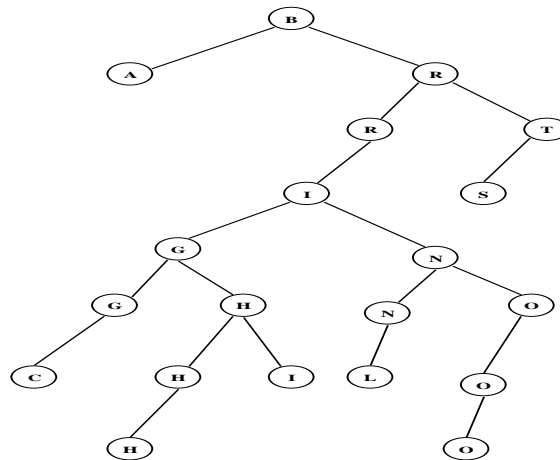
$$\begin{aligned}
 A(\bar{B} + C) + \bar{B}(\bar{A} + \bar{C}) + C(\bar{A}\bar{B}) &= A\bar{B} + AC + \bar{A}\bar{B} + \bar{B}\bar{C} + \bar{A}\bar{B}C \\
 &= (A\bar{B} + \bar{A}\bar{B} + \bar{B}\bar{C} + \bar{A}\bar{B}C) + AC \\
 &= \bar{B}(A + \bar{A} + C + AC) + AC = \bar{B} + AC
 \end{aligned}$$

If $\bar{B} + AC$, then $\bar{B} = 0 \wedge AC = 0$. So $B = 1$ and both $A \wedge C$ cannot be 1. Therefore (0,1,0), (0,1,1) and (1,1,0) make it FALSE.

7. (0,1,0)
(0,1,1)
(1,1,0)

8. Data Structures

The binary search tree has a depth of 7. The nodes at depth 6 are C, H, I, L, O. (This is the site of this year's All-Star Contest.)



8. C, H, I, L, O

9. Data Structures

The stack is constructed using LIFO as follows: F, FO, FOR, FO, FOT, FOTI, FOT, FOTE, FOTET, FOTE, FOTEH, FOTEHA, FOTEHAN, FOTEHA, FOTEHAN, FOTEHA, FOTEH, FOTEHI, FOTEHIV, FOTEHIVE, FOTEHIVER, FOTEHIVE, FOTEHIV, FOTEHIVS, FOTEHIV, FOTEHI, FOTEHIA, FOTEHIAR, FOTEHIARY, FOTEHIAR, FOTEHIA, FOTEHI, FOTEH, FOTE.

The next item popped is a E. (This is ACSL's 40th year.)

9. E

10. Regular Expressions

Given: $1^*01(01)^*1100^*$

- A. 0010100 - fails - must start with 01 not 00
- B. 101011100 - matches
- C. 01010101100 - fails - missing a 1, should end with 11100
- D. 1010110 - fails - should end with 1110
- E. 01110 - matches

10. B, E

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American Computer Science League

Contest #3

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