2001-2002 **American Computer Science League** **Contest #2**

Classroom Division **Solutions**

1. This program finds the largest factor of X, less than X, by counting counting down from X until it finds a factor. The loop ends when C changes from zero.	1. 10
2. $\overline{X}(X+\overline{Y})+\overline{Y}(\overline{Y}+\overline{Z})+\overline{Y}=\overline{X}X+\overline{X}\overline{Y}+\overline{Y}\overline{Y}+\overline{Y}\overline{Z}+\overline{Y}=$ $0+\overline{X}\overline{Y}+\overline{Y}+\overline{Y}\overline{Z}+\overline{Y} = \overline{X}\overline{Y}+\overline{Y}+\overline{Y}\overline{Z}=\overline{Y}(\overline{X}+1+\overline{Z}) = \overline{Y}$	2. $\overline{Y}$
3. $\overline{A}+AB+A\overline{B}= \overline{A}+A(B+\overline{B})= \overline{A}+A=1$. The 1 denotes that the expression is always TRUE. All 4 possible inputs must be listed.	3. (1,1), (1,0), (0,1), (0,0)
4. Working from the inside out: RSHIFT–1 10100 = 01010 LCIRC–2 01010 = 01001 LSHIFT–2 01001 = 00100	4. 00100
5. Let X=abcde. The equation becomes 00110 OR abcde = 10110. Consider the equation bit by bit. 0 OR a = 1 implies a = 1 0 OR b = 0 implies b = 0 1 OR c = 1 implies c can be either a 1 or a 0 1 OR d = 1 implies c can be either a 1 or a 0 0 OR e = 0 implies e = 0 (1, 0, ∗, ∗ , 0) gives 4 possible solutions	5. 4

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6. Change 567_8 to hexadecimal and subtract. $A12_{16} - 177_{16} = 89B_{16}$.
$89B_{16}$ converts to 100010011011_2.

6. 100010011011_2.

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7. $(\overline{X}+Y)(\overline{X}+\overline{Y}) = \overline{X}\;\overline{X} + \overline{X}\;\overline{Y} + \overline{X}\;Y + Y\;\overline{Y} = \overline{X} + \overline{X}\;\overline{Y} + \overline{X}\;Y + 0 =$
$\overline{X} + (1+\overline{Y}+Y) = \overline{X} + 1 = \overline{X}$

7. $\overline{X}$

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8. $\overline{AB} + A(\overline{B+C}) = \overline{A} + \overline{B} + A\;\overline{B}\;\overline{C} = \overline{A}+\overline{B}(1+A\overline{C}) = \overline{A}+\overline{B} = \overline{AB}$
Now if $\overline{AB}=0$, then $AB=1$ which implies $A=1$ and $B=1$.
Therefore, the solution is in the form (1,1,∗)

8. (1,1,1) and (1,1,0)

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9. Working from the inside out:

RSHIFT–2 10011 = 00100
RCIRC–8 00100 = RCIRC–3 00100 = 00001
RSHIFT–2 00001 = 00100

9. 00100

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10. Let X = abcde.
RSHIFT–1 abcde = 0abcd
0abcd OR 10110 AND 00101 = 00101
Since AND has precedence over OR
10110 AND 00101 = 00100
0abcd OR 00100 = 00101
Evaluating one bit at a time gives:
a OR 0 = 0 implies a = 0
b OR 1 = 1 implies b = ∗
c OR 0 = 0 implies c = 0
d OR 0 = 0 implies d = 1
e = ∗
The 4 solutions take the form (0, ∗ , 0, 1, ∗)

10. 4