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

Intermediate Division **Solutions**

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

1. 100010011011_2.

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

2. $\overline{X}$

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

3. (1,1,1) and (1,1,0)

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4. Working from the inside out:

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

4. 00100

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5. 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, ∗)

5. 4