ACSL

2006 - 2007 **American Computer Science League** **Contest #3**

Intermediate Division Solutions

1. **Boolean Algebra**

$A\overline{B}\overline{C} + A\overline{B}\overline{C} + \overline{A}BC + \overline{A}\overline{B}C = A\overline{C}(B+\overline{B}) + \overline{A}C(B+\overline{B}) =$

$A\overline{C} + \overline{A}C = A \oplus C \Rightarrow$ A=1, B = *, C = 0 OR A = 0, B = * C = 1

1. 4

2. **Graph Theory**

The cycles from vertex A are: AA, ABA, AEA, ABEA, ADEA, ADCBA, ADCBEA

2. 7

3. **Graph Theory**

$$\begin{vmatrix} 0 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 \end{vmatrix} \begin{vmatrix} 3 \end{vmatrix} = \begin{vmatrix} 3 & 3 & 2 & 4 \\ 5 & 5 & 2 & 5 \\ 5 & 5 & 2 & 5 \\ 4 & 4 & 1 & 3 \end{vmatrix}$$

3. 4

4. **Digital Electronics**

The circuit simplifies to $\overline{\overline{A}B + \overline{BC}} = \overline{\overline{A}B} * \overline{\overline{BC}} = (A+\overline{B})(BC) =$

$ABC + \overline{B}BC = ABC + 0 = ABC$

4. ABC

5. **Digital Electronics**

The circuit translates to $\overline{\overline{A}(A+B)} + \overline{B\overline{C}+D} = 0$

$\overline{\overline{A}A + \overline{A}B} + \overline{B\overline{C}}\,\overline{D} = 0$

$\overline{(\overline{A}A)}\overline{(\overline{A}B)} + \overline{B\overline{C}}\,\overline{D} = 0$

$\overline{\overline{A}B} + (\overline{B}+C)\overline{D} = 0$

$A + \overline{B} + \overline{B}\overline{D} + C\overline{D} = 0 \Rightarrow$ all 4 terms must be 0.

If D = 0 $\Rightarrow$ C = 0 $\Rightarrow$ (0,1,0,0)

If D = 1 $\Rightarrow$ C = * $\Rightarrow$ (0,1,*,1)

5. 3