ACSL

2016 - 2017 **American Computer Science League** **Contest #4**

Senior Division Solutions

1. Graph Theory

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

Adding all the entries in the second matrix gives the number of paths of length 2. There are 29 of them.

1. 29

2. Graph Theory There are 8 cycles: AA, ABA, ABCA, ABDA, ABDCA, ACA, ADA, and ADCA

2. 8

3. Digital Electronics The circuit translates to: $\overline{\overline{((A+\overline{B})+\overline{\overline{B}})}B}$

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

This is only FALSE when both are FALSE. Only one ordered pair satisfies this condition: (0, 1)

3. (0, 1)

4. Digital Electronics

The circuit translates to: $((\overline{A}+(A+B))+(B+\overline{C}))+\overline{C}$

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

$=1+B+\overline{C} = 1$

4. 1

5. Assembly Language

This program determines the prime factorization of 288 written as individual factors. 288 = 2 x 2 x 2 x 2 x 2 x 3 x 3

5. 2
2
2
2
2
3
3