2001-2002 **American Computer Science League** **Contest #3**

Junior Division Short Problem Solutions

1. The last time the 2 loops are executed prior to ending, J has a value of 1 and K has a value of 9 since K assumes values of 3,5,7 and 9. Therefore, B(1,9) is the last element modified

1. B(1,9)

2. Without any simplification, the circuit translates as follows:

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

2. $A\ (\ \overline{A}\ +\ \overline{B}\ )$

3. The circuit translates as follows : $\overline{A + \overline{B}\ C}$

Using DeMorgan's Theroem gives: $\overline{A}\ (\ \overline{\overline{B}\ C}\ )$. To be TRUE, both factors must be TRUE. A must always be 0. The second factor must be FALSE since the negation will make it true. Two possibilities exist. Either ($\overline{B}$, C) equals (*****, 0) or (1, 1). There are 3 ordered triples that make the circuit TRUE.

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

4. The squaring the adjacency matrix produces all the paths of length 2. Summing the elements gives 9 paths of length 2.

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

4. 9

5. The cycles in the graph are: ABCA, ABCDA, ACA and ACDA

5. 4