# American Computer Science League

**2018-2019** **Contest #4**

## JUNIOR DIVISION SOLUTIONS

**1. Graph Theory**

$$\begin{vmatrix} 0 & 1 & 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 \end{vmatrix}$$

**1.** As shown

**2. Graph Theory**

To find the number of paths of length 2, add the entries in the square of the adjacency matrix. The sum is 16.

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

**2.** 16

**3. Digital Electronics**

The circuit translates to the following Boolean expression: $(A+B)\overline{B}$

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

This is TRUE only when both are TRUE. So (1, 0) makes the circuit TRUE.

**3.** (1, 0)

**4. Digital Electronics**

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

Note: the operands within a gate may be commuted.

**4.** $\overline{(AB)(\overline{B+C})} + \overline{C}$

**5. What Does This Program Do? - Strings**

The first loop divides the string into two strings: B = "EJEEIHEGADEAE" and C = "NWRSYSTRNSTT". The next loop eliminates E's from B and S's from C resulting in D = "JIHGADA" and E = "NWRYTRNTT".
The last loop drops A's from D and R's from E within the first 6 characters of each and constructs F from the middle outwards. The output is GIJNWY.

**5.** GIJNWY