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

Intermediate Division **Solutions**

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1. The circuit translates as follows: $(A + B)\,\overline{B}$.
To be TRUE both factors must be TRUE. B must be equal to 0.
Therefore, A must be equal to 1.

1. (1,0)

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2. The circuit translates as follows: $(\overline{\overline{X}\,Y})\,(Y \oplus \overline{Z})$. It simplifies to:
$(X + \overline{Y})\,(YZ + \overline{Y}\,\overline{Z}) = XYZ + X\,\overline{Y}\,\overline{Z} + \overline{Y}\,Y\,Z + \overline{Y}\,\overline{Y}\,\overline{Z} =$
$XYZ + X\,\overline{Y}\,\overline{Z} + \overline{Y}\,\overline{Z} = XYZ + \overline{Y}\,\overline{Z}\,(X + 1) = XYZ + \overline{Y}\,\overline{Z}$

2. $XYZ + \overline{Y}\,\overline{Z}$

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3. The expression simplifies as follows:
$\overline{A}\,B + \overline{A}\,\overline{C} + \overline{A}\,\overline{B} + \overline{B}\,C + A\,\overline{C} + \overline{B}\,\overline{C} =$
$(\overline{A}\,B + \overline{A}\,\overline{B}) + (\overline{B}\,C + \overline{B}\,\overline{C}) + (A\,\overline{C} + \overline{A}\,\overline{C}) =$
$\overline{A}\,(B + \overline{B}) + \overline{B}\,(C + \overline{C}) + \overline{C}\,(A + \overline{A}) =$
$\overline{A} + \overline{B} + \overline{C} = \overline{ABC}$ (*note that* $\overline{A}\,\overline{B}\,\overline{C}$ *is not equivalent)*

3. $\overline{ABC}$

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4. By definition a simple path is a path with no vertex repeated. Choice A is not a valid path. Choice B has vertex B repeated. Choice C is a simple path. Choice D is not a valid path.

4. C

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5. A “1” is placed in the matrix when a path exists. Otherwise, the matrix contains a “ 0”.

	A	B	C	D
A	1	1	0	1
B	1	0	1	1
C	0	0	0	1
D	0	0	1	0

5. The matrix as shown at the left.