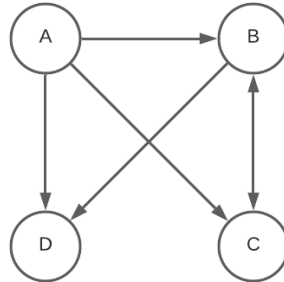


American Computer Science League

2021-2022 • Contest 4: Short Problems Solutions • Intermediate Division

1. Graph Theory



B. 3

The original directed graph is:

0	1	1	1	2		0	1	1	1
0	0	1	1			0	1	0	0
0	1	0	0		=	0	0	1	1
0	0	0	0			0	0	0	0

This graph has 6 paths of length 2.

Now add directed edge DC.

0	1	1	1	2		0	1	2	1
0	0	1	1			0	1	1	0
0	1	0	0		=	0	0	1	1
0	0	1	0			0	1	0	0

This graph has 9 paths of length 2 (3 more).

2. Graph Theory

The cycles from A are : AFCDA, AFEBA, AFEBCDA, AFEDA, ADA
There are 3 cycles of length 4: AFCDA, AFEBA, and AFEDA.

C. 3

<p>3. Digital Electronics</p> <p>The Boolean expression represented by the following digital circuit is:</p> $\overline{A + AB(B\overline{C} + C)} = (\overline{A} \overline{AB} (\overline{B} + \overline{C} + C))$ $= \overline{A} (\overline{A} + \overline{B}) 1$ $= \overline{A} + \overline{A} \overline{B}$ $= \overline{A} (1 + \overline{B})$ $= \overline{A}$	<p>A. \overline{A}</p>
<p>4. Digital Electronics</p> <p>The Boolean expression for the digital circuit is:</p> $(\overline{AB} \oplus (B + C)) C = \overline{(\overline{AB} (B + C) + \overline{AB} \overline{B} + \overline{C})} C$ $= (\overline{AB} + \overline{AB} C + (\overline{A} + \overline{B}) \overline{B} \overline{C}) C$ $= (\overline{AB} + \overline{A} \overline{B} \overline{B} \overline{C}) C$ $= \overline{AB} C$ <p>This is TRUE for only (1, 1, 1)</p>	<p>B. 1</p>
<p>5. Assembly Language</p> <p>This program prints the factors of 12 (1, 2, 3, 4, 6, 12). There are 6 of them.</p>	<p>E. 6</p>