ACSL

American Computer Science League

2019-2020 **Contest #4**

INTERMEDIATE DIVISION SOLUTIONS

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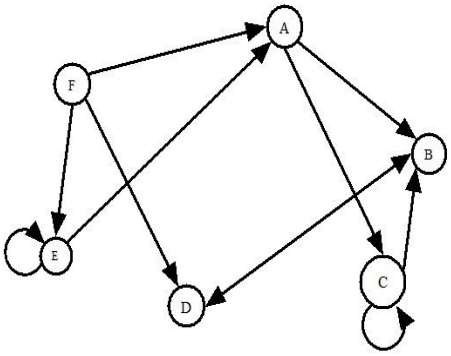
1. Graph Theory

There are 7 different pairs of vertices with no direct edge between them:



AD, BE, BF, CD, CE, CF, and DE.

1. 7

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2. Graph Theory

$$M=\begin{bmatrix}0&1&1&0\\0&0&0&0\\0&1&1&0\\1&0&0&0\end{bmatrix} \quad M^2=\begin{bmatrix}0&1&1&0\\0&0&0&0\\0&1&1&0\\0&1&1&0\end{bmatrix} \quad M^3=\begin{bmatrix}0&1&1&0\\0&0&0&0\\0&1&1&0\\0&1&1&0\end{bmatrix}$$

There are 6 paths of length 2 and 6 paths of length 3. The difference is 0.

2. 0

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3. Digital Electronics

The digital circuit translates to:

$$(A + \overline{AB})\left(\overline{B + C}\right)$$
$$= (A + \overline{A} + \overline{B})\ \overline{B}\,\overline{C}$$
$$= \left(1 + \overline{B}\right)\overline{B}\,\overline{C}$$
$$= \overline{B}\,\overline{C}$$

3. $\overline{B}\,\overline{C}$ or $\overline{B + C}$

.

Either answer is accepted.

4. Digital Electronics

The digital circuit translates to:

$$\overline{A + \overline{(A + BC)\,C}}$$
$$= \overline{A}(A + BC)\,C$$
$$= \overline{A}AC + \overline{A}BC$$
$$= 0 + \overline{A}BC$$
$$= \overline{A}BC$$

So (0,1,1) makes it TRUE.

4. 1

5. Assembly Language

An equivalent program using our WDTPD language is:

```
X = 8
Y = 15
while X * X - Y >= 0
   X = X - 1
   Y = Y - 1
end while
output X
```

X	8	7	6	5	4	3
Y	15	14	13	12	11	10
X*X-Y	49	35	23	13	5	-1

5. 3