

# American Computer Science League

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

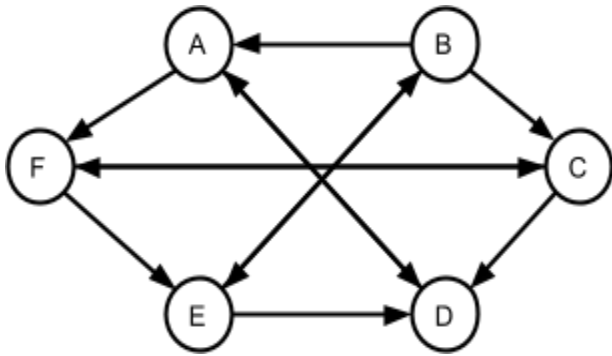
## 1. Graph Theory

Given a directed graph with vertices  $\{A, B, C, D\}$  and edges  $\{AB, CB, AD, BC, BD, AC\}$ , if edge  $DC$  were added, how many more paths of length 2 would there be?

- A. 2
- B. 3
- C. 5
- D. 6
- E. 9

## 2. Graph Theory

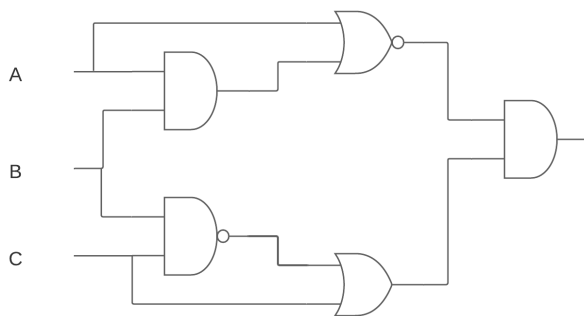
How many cycles of length 4 are there from A?



- A. 1
- B. 2
- C. 3
- D. 4
- E. 5

## 3. Digital Electronics

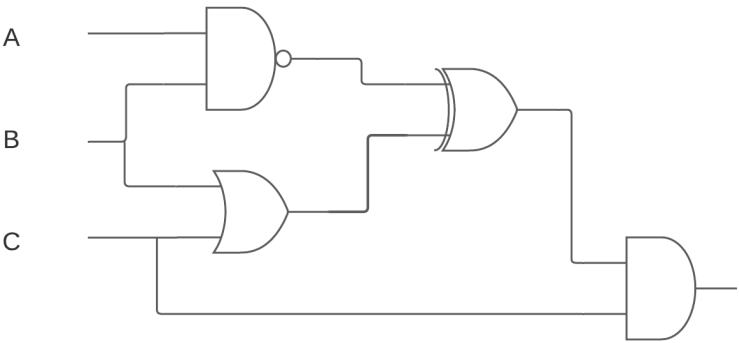
Simplify the Boolean expression represented by the following digital circuit.



- A.  $\overline{A}$
- B.  $\overline{A} + \overline{B}$
- C.  $\overline{B}$
- D.  $\overline{B} + \overline{C}$
- E.  $\overline{C}$

4. Digital Electronics

How many ordered triples make the following digital circuit TRUE?



- A. 0
- B. 1
- C. 4
- D. 7
- E. 8

5. Assembly Language

How many values are printed when this program is executed?

```
A          DC          12
B          DC          1
TOP        LOAD        A
           DIV         B
           STORE       C
           LOAD        B
           MULT        C
           STORE       D
           LOAD        A
           SUB         D
           BE          OUT
IN          LOAD        A
           SUB         B
           BE          STOP
           LOAD        B
           ADD         =1
           STORE       B
           BU          TOP
OUT         PRINT      B
           BU          IN
STOP       END
```

- A. 2
- B. 3
- C. 4
- D. 5
- E. 6