

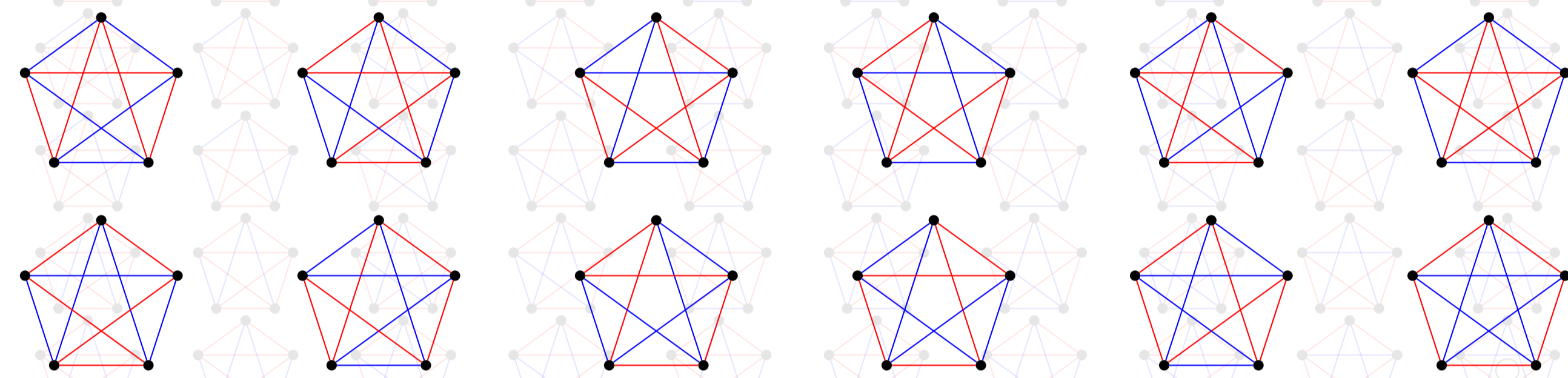
# How many 2-colorings of $K_5$ have no 1-colored $K_3$ ?

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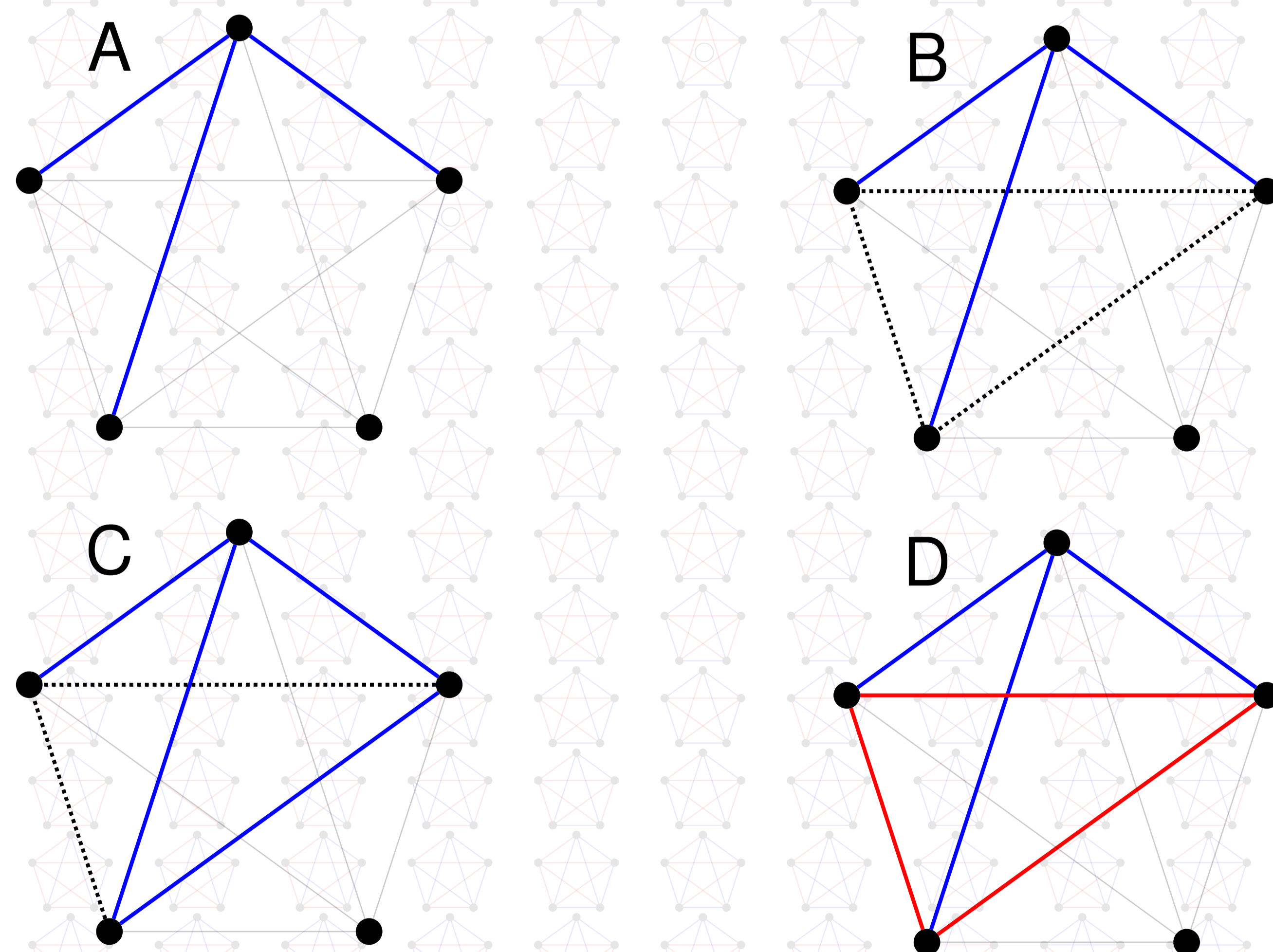
## Introduction

Of the 1024 possible 2-colorings of  $K_5$ , only 12 have no 1-colored triangles.



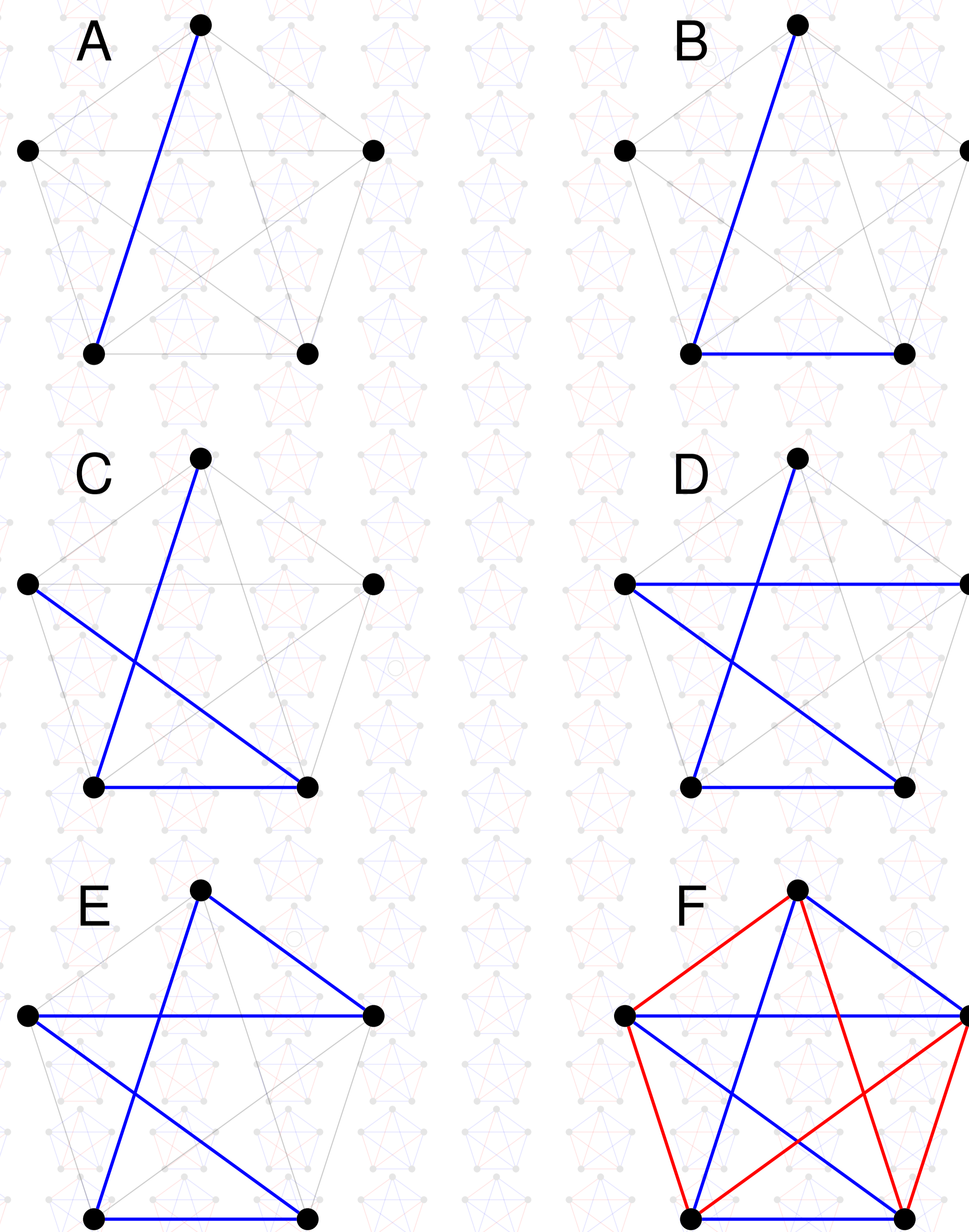
## Claim 1

If any 3 edges match, then there is a 1-colored triangle.



## Claim 2

If  $G$  has no 1-colored triangles, then  $G$  has a 1-colored 5-cycle.

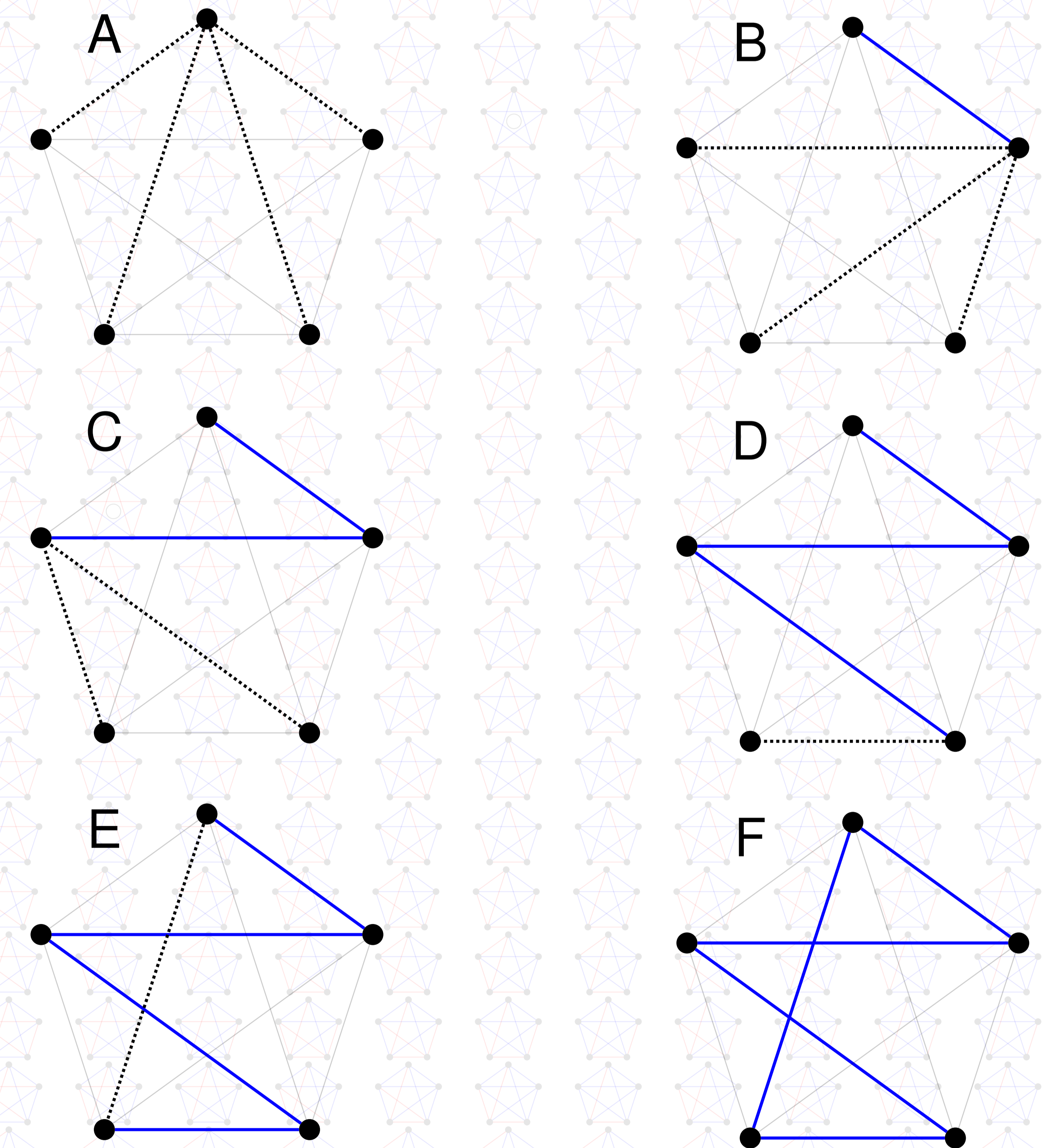


E: 1-colored 5-cycle

F: Remaining edges form a 5-cycle

## Claim 3

There are 12 ways to construct a 1-colored 5-cycle.



$$\frac{4 \cdot 3 \cdot 2 \cdot 1 \cdot 1}{2} = 12$$