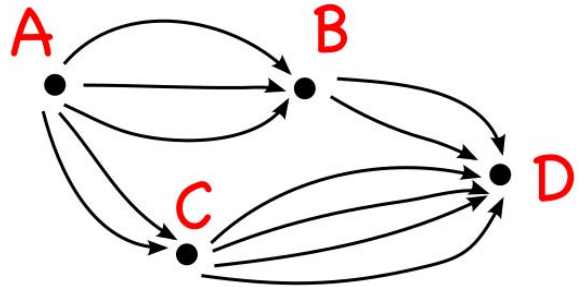


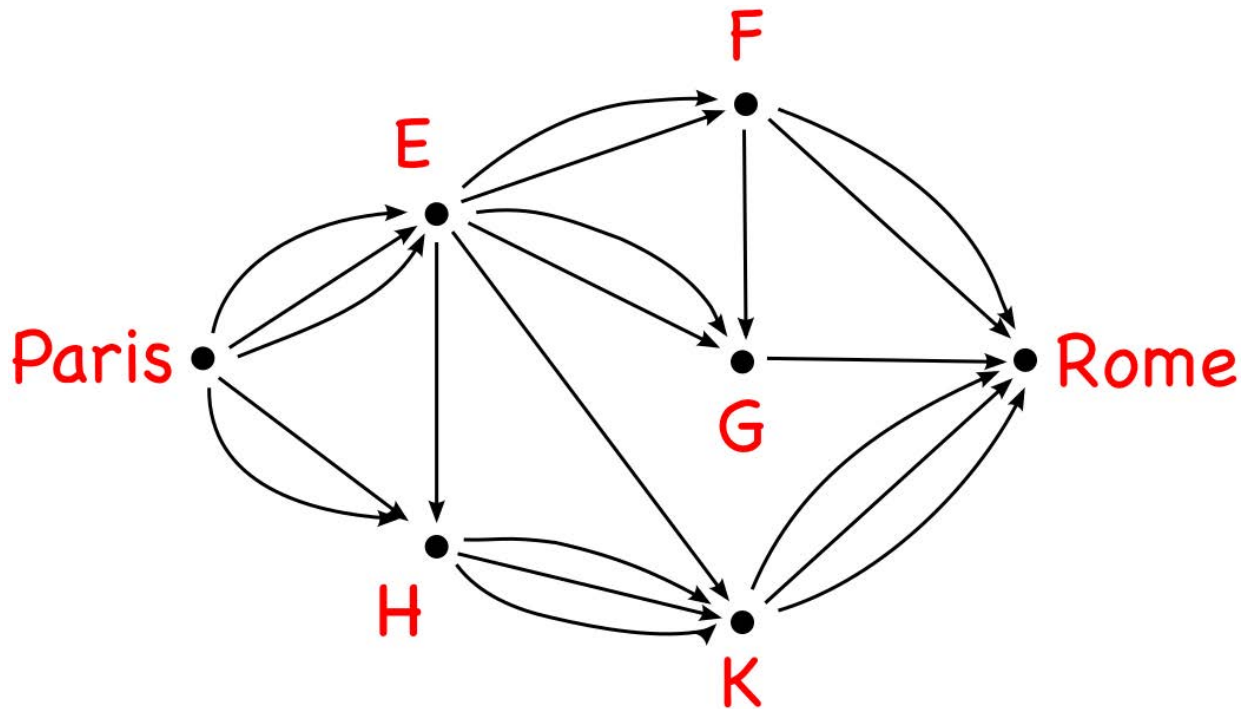
# Puzzle of the Week

## *All Roads Lead to Rome – 2*

This map shows a collection of one-way roads going between cities A, B, C, and D. To get from A to D you can either go through B or C. There are  $3 \times 2 = 6$  ways of going from A to D if you go through B. There are  $2 \times 4 = 8$  ways of going from A to D if you go through C. Therefore, there are a total of  $6 + 8 = 14$  ways of going from A to D.



**THE CHALLENGE:** Here is a complicated pretend map of one-way roads leading from Paris to Rome. How many possible routes are there?



**EXPLORATION:** Why does this puzzle not work using two-way roads? Make some fun maps for your friends to puzzle over.

# Puzzle of the Week

## *All Roads Lead to Rome – 2 – Notes*

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**THE CHALLENGE:** This puzzle involves several important counting methods.

- If you have independent ways to do two steps of something, the total number of ways is the product of the number of ways of doing each of the steps..
- If two things are completely separate, then their ways add up.
- You can sometimes count things by flooding out from a beginning point.

Let's start in Paris and make our way to Rome.

- E - There are 3 ways to get to E from Paris.
- H - There are 2 ways to get here directly from Paris, and  $3 \times 1 = 3$  ways of getting to H from E. Therefore, there are a total of  $2 + 3 = 5$  ways of getting to H from Paris.
- F - 3 ways to go from Paris to E; 2 ways to get from E to F; so  $3 \times 2 = 6$  ways from Paris to F.
- G - There are two kinds of routes for getting to G - either directly from E or from F. There are  $3 \times 2$  ways of getting to G straight from E. There are  $6 \times 1 = 6$  ways of getting to G from F. Thus, there are a total of  $6 + 6 = 12$  ways of getting to G.
- K - You can get to K either from H or E. Going through H there are  $5 \times 3 = 15$  ways. Going through E there are  $3 \times 1 = 3$  ways. Altogether there are  $15 + 3 = 18$  ways of getting to K.
- Rome - The last step of going to Rome can be through F, G, or K. Through F there are  $6 \times 2 = 12$  ways. Through G there are  $12 \times 1 = 12$  ways. Through K there are  $18 \times 3 = 54$  ways. That makes a grand total of  $12 + 12 + 54 = 78$  ways of going from Paris to Rome.

**EXPLORATION:** If you have two-way roads, that would create loops that would create an infinite number of possible routes.