The Traveling Salesman Problem – Solution

Lecture 29
Sections 6.1, 6.3, 6.4, 6.5

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Outline

Assignment

Assignment

- Page 198: Exercises 29, 43, 49, 53.

Outline

Greedy Algorithms

Definition (Greedy Algorithms)

A greedy algorithm is an algorithm that, like greedy people, grabs what looks best in the short run, whether or not it is best in the long run.

- Greedy algorithms optimize locally, but not necessarily globally.
- The benefit of greedy algorithms is that they are simple and fast.

Approximate Algorithms

Definition (Approximate Algorithm)

An approximate algorithm is an algorithm that gives a good solution, but not necessarily the best solution.

- We will look at two greedy, approximate algorithms to handle the Traveling Salesman Problem.

Outline

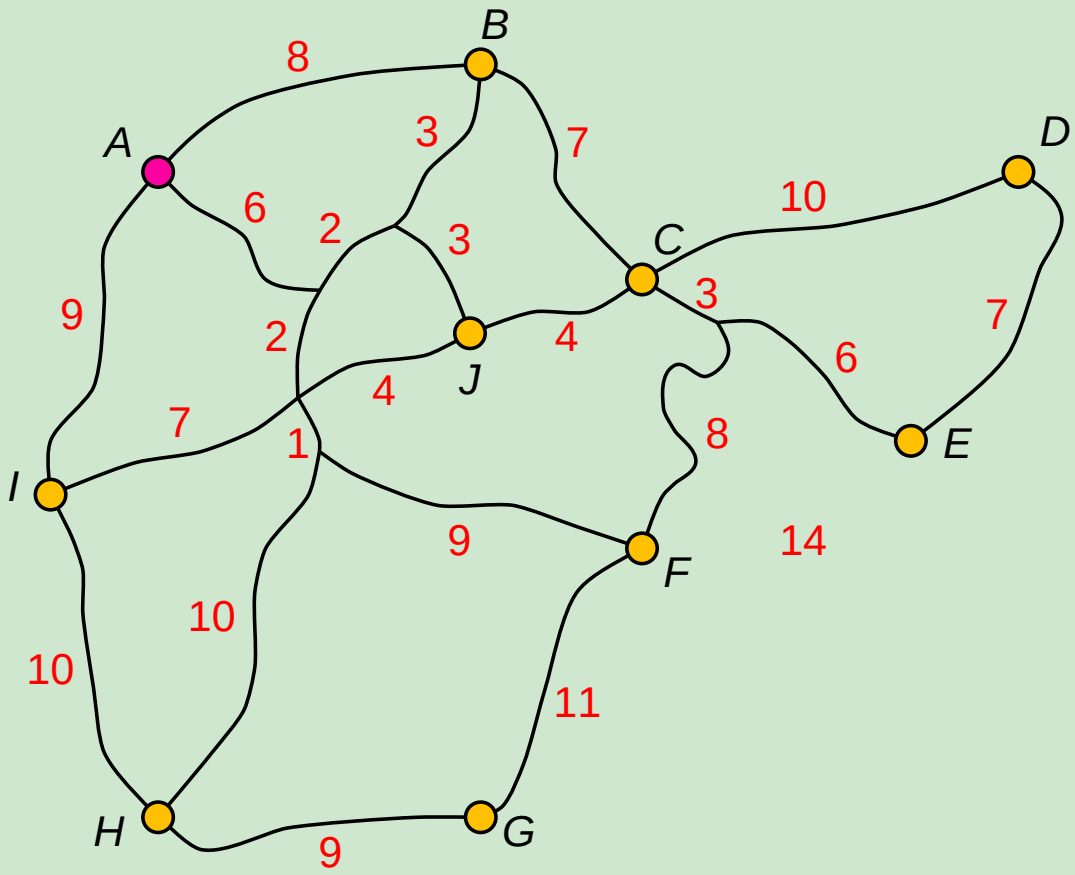
The Nearest-Neighbor Algorithm

Definition (Nearest-Neighbor Algorithm)

The Nearest-Neighbor Algorithm begins at any vertex and follows the edge of least weight from that vertex. At every subsequent vertex, it follows the edge of least weight that leads to a city not yet visited, until it returns to the starting point.

Example

Example (Nearest-Neighbor Algorithm)



Example

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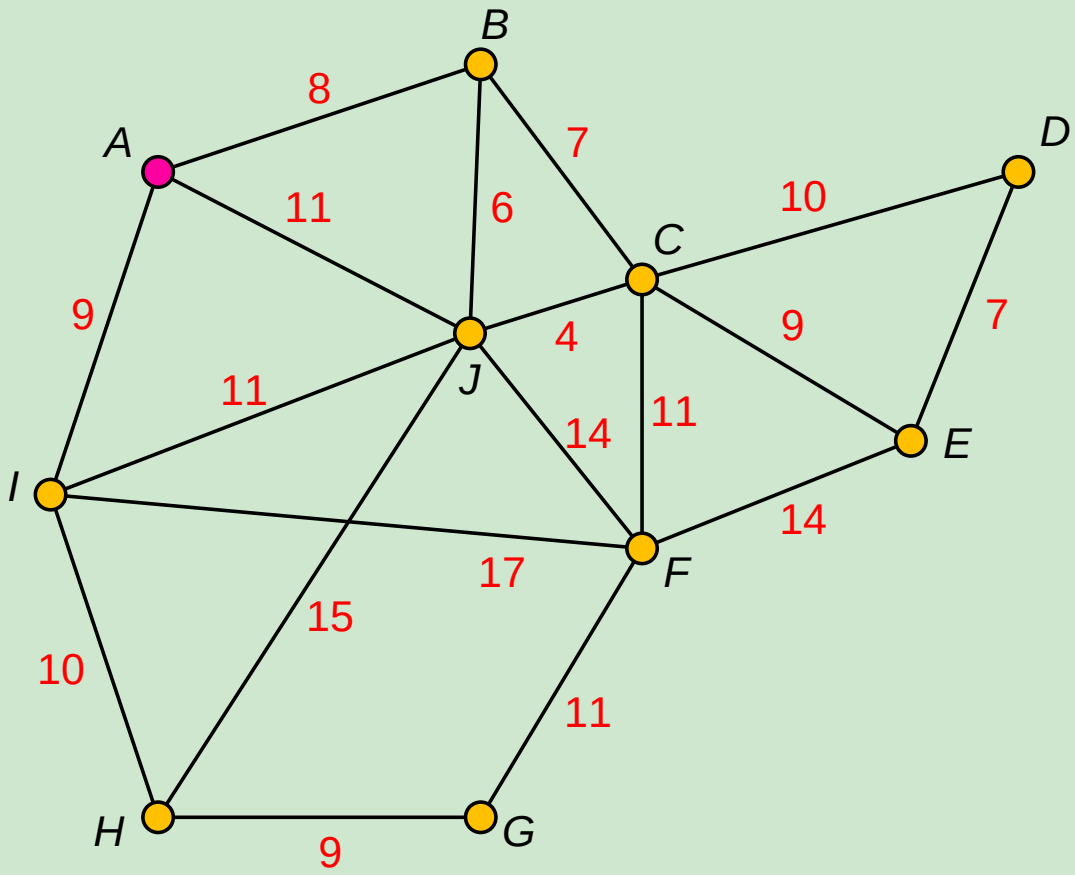

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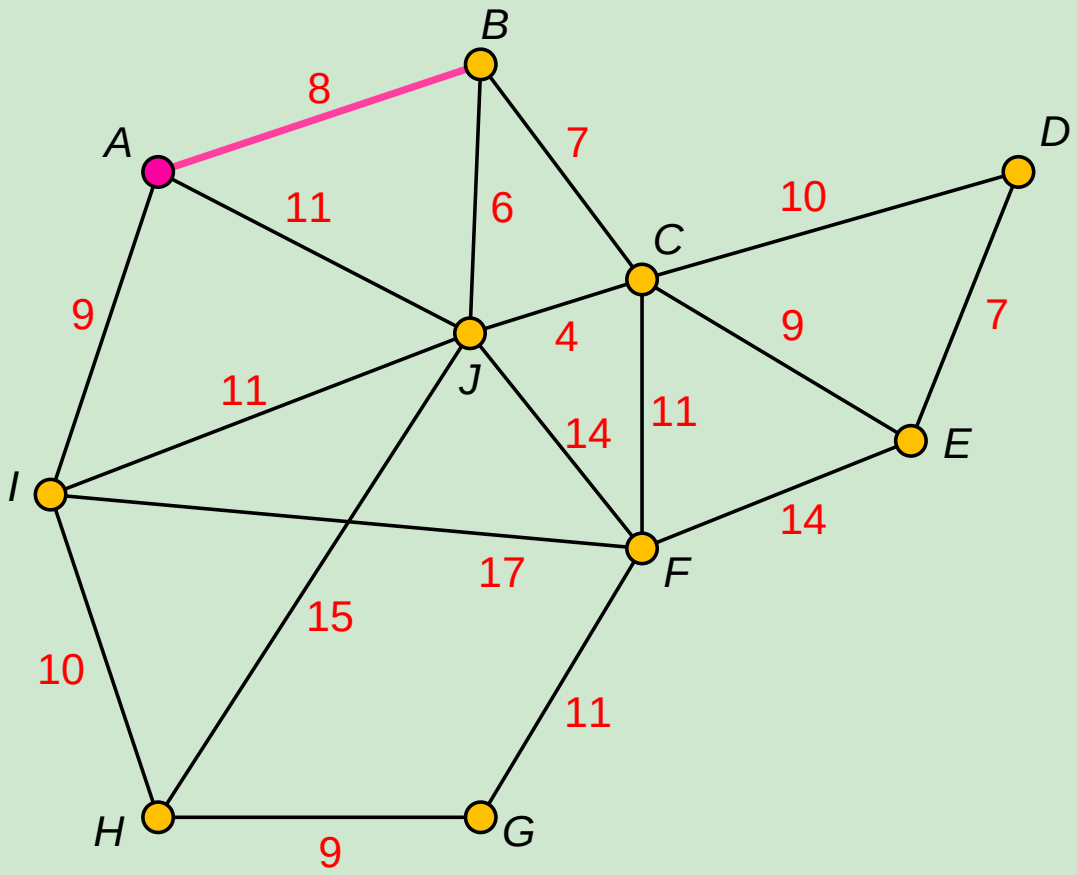

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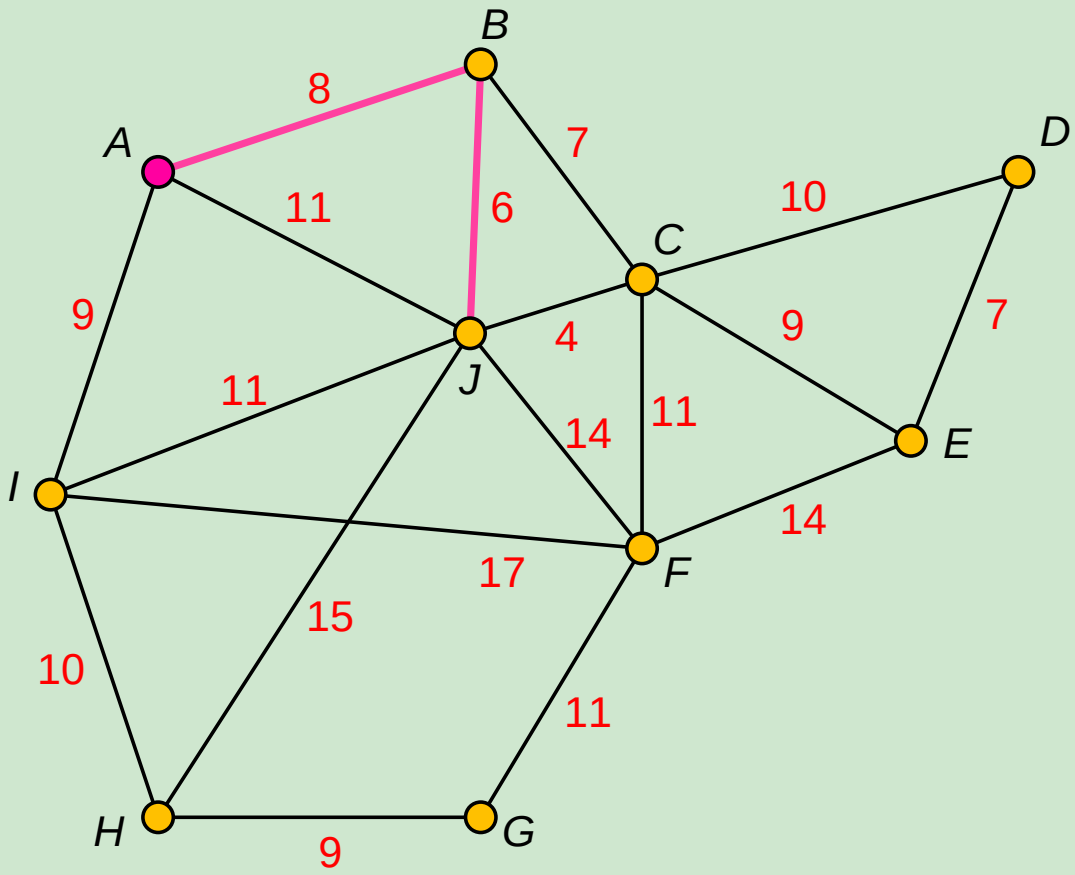

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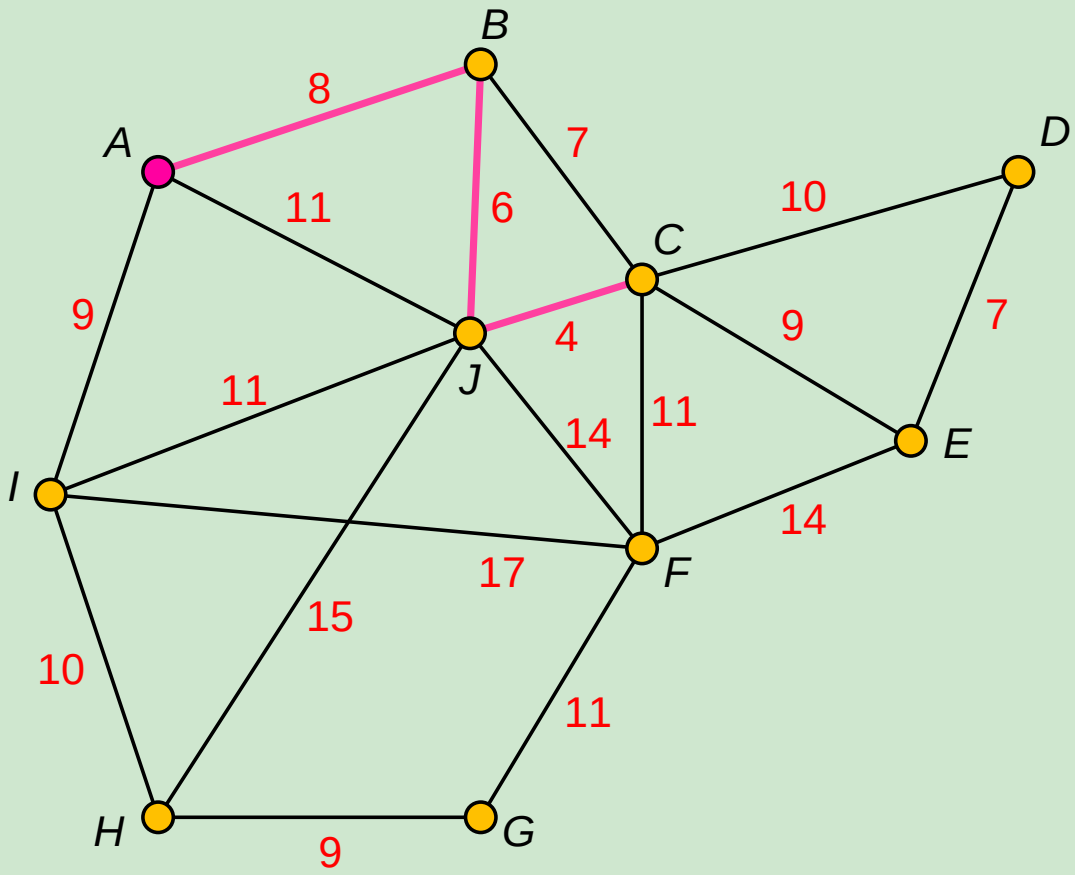

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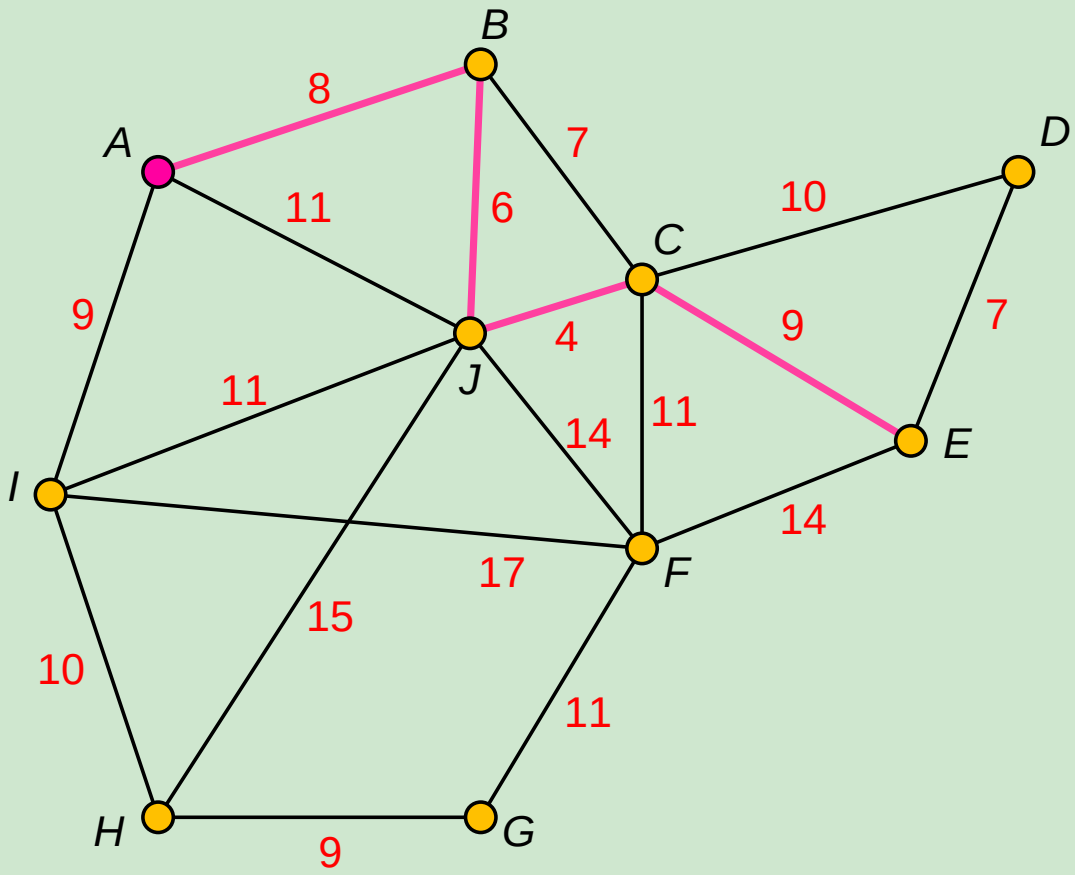

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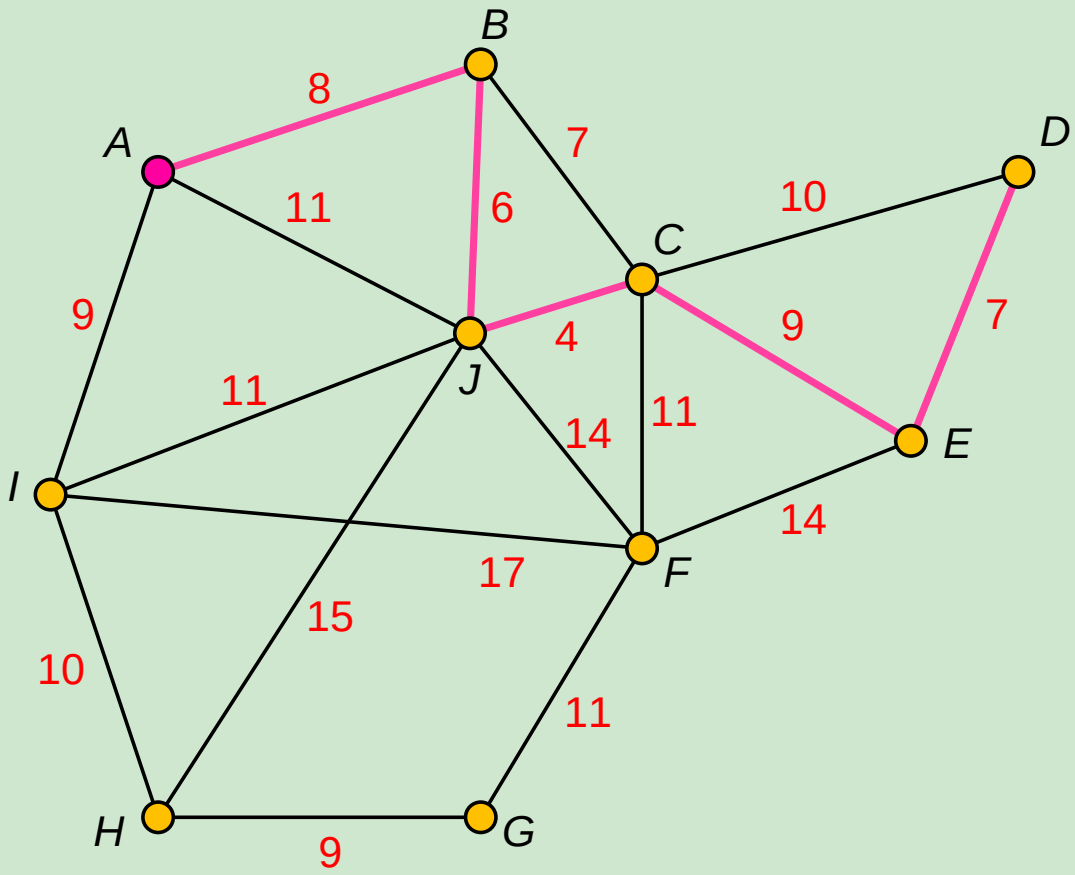

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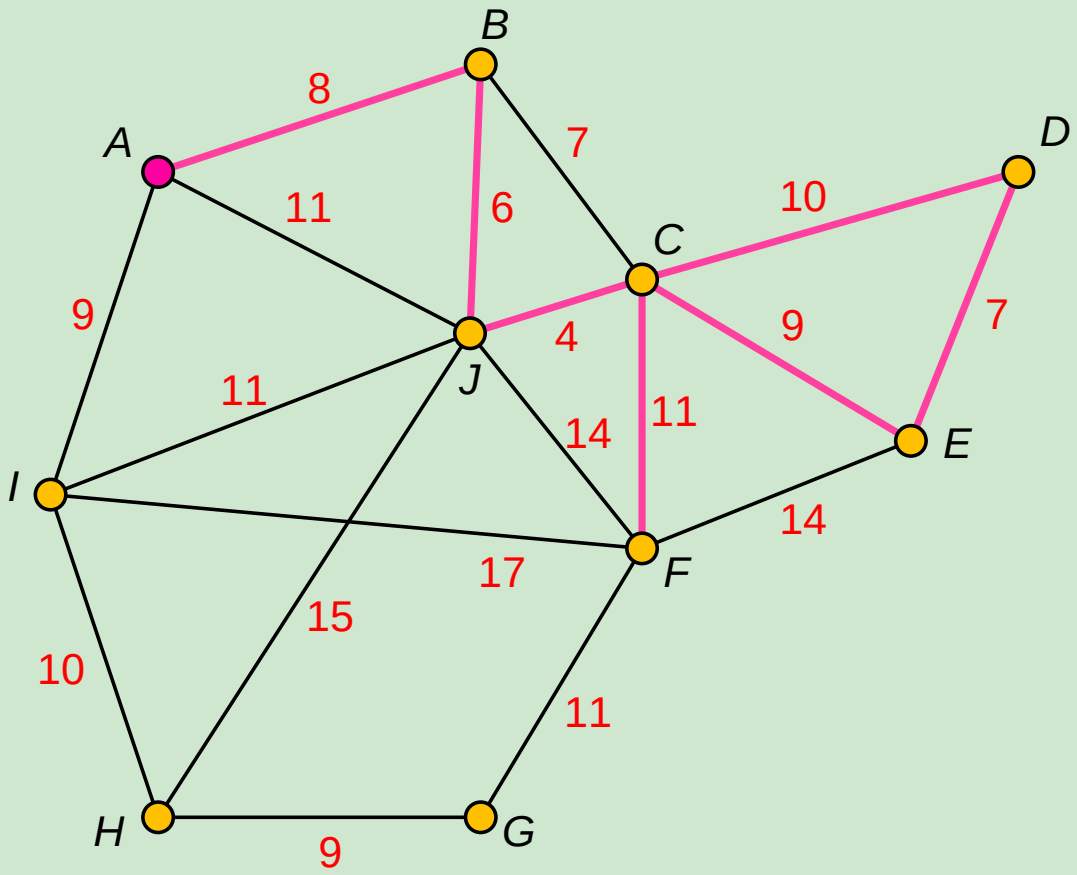

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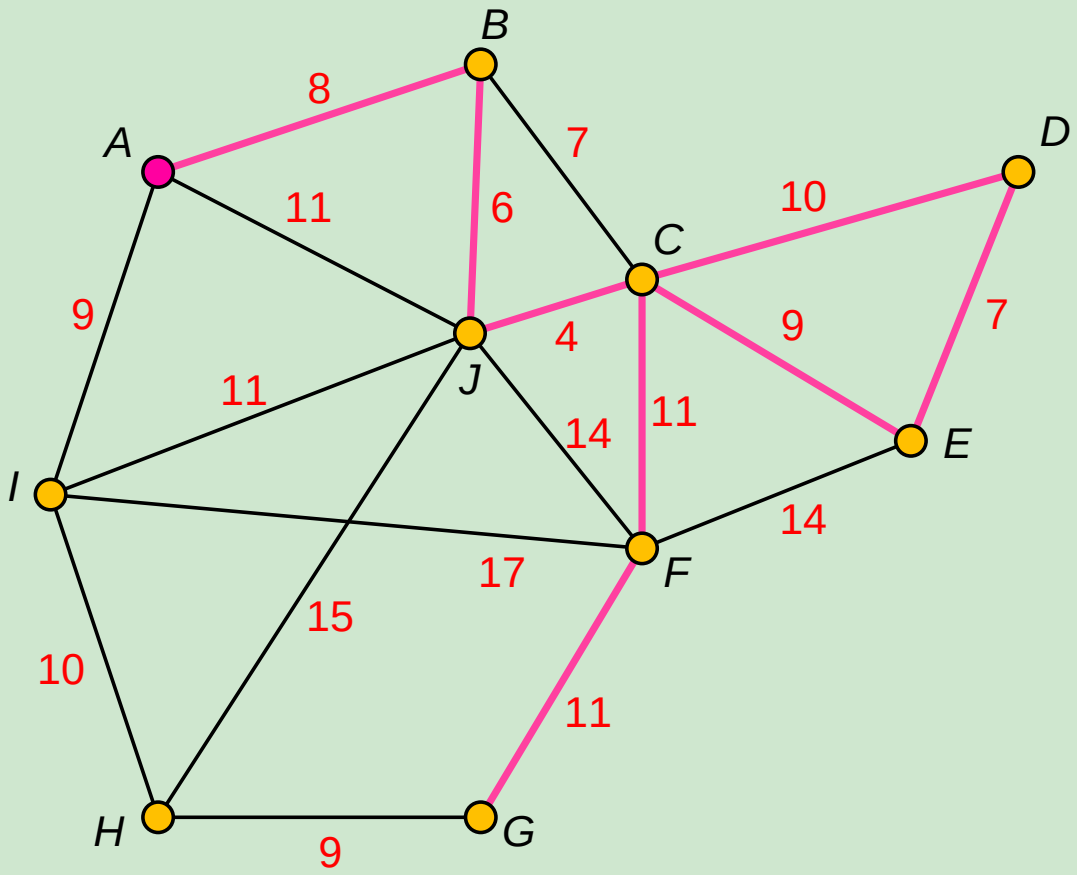

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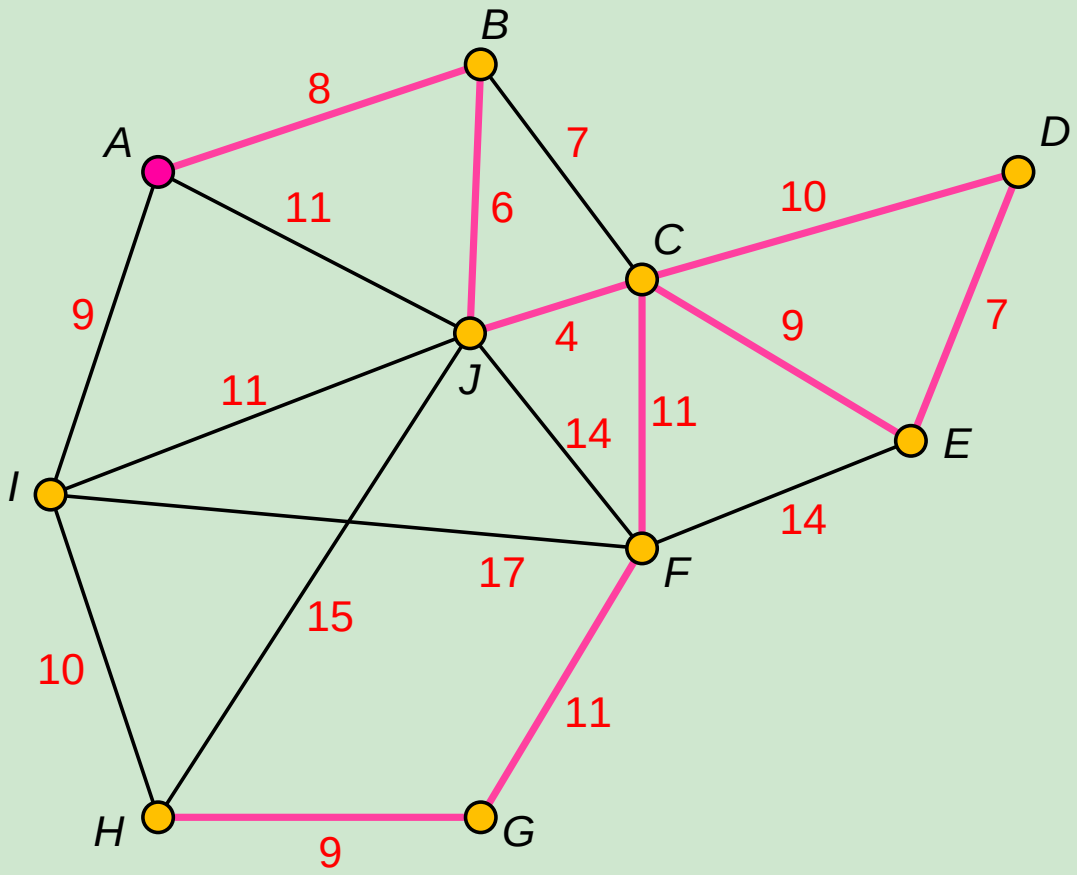

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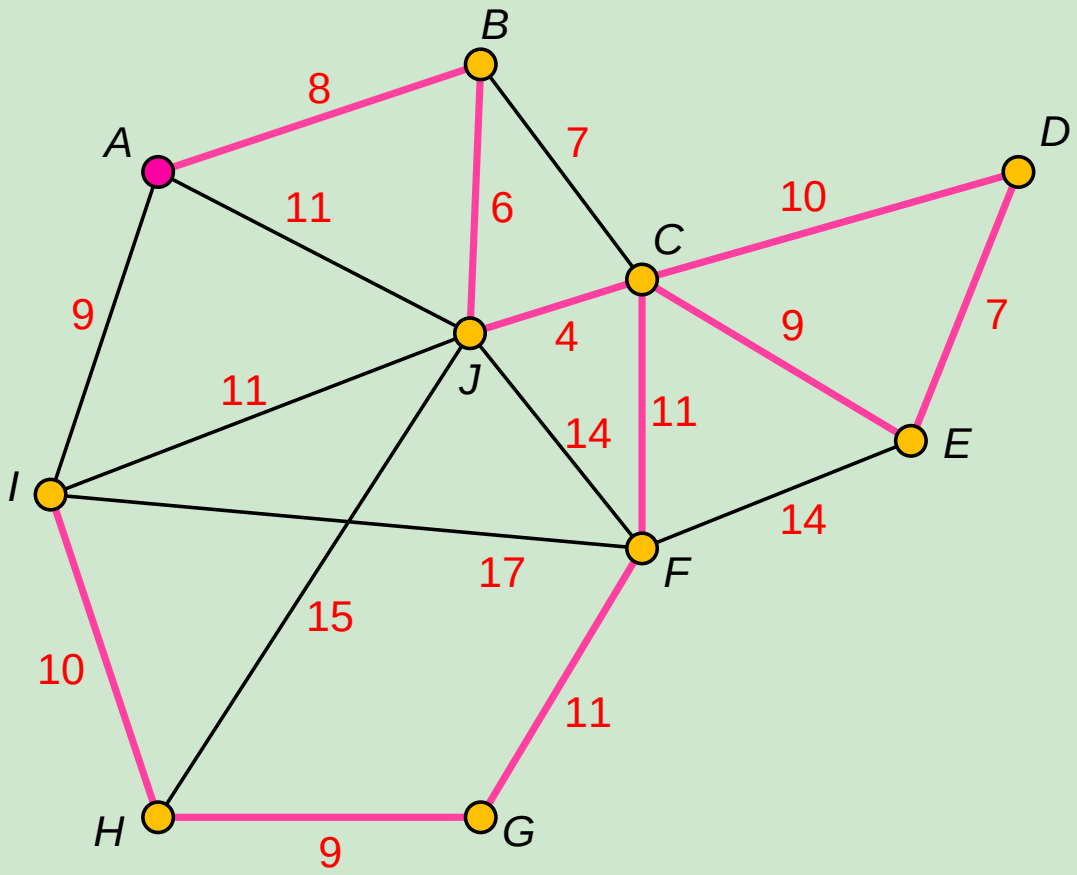

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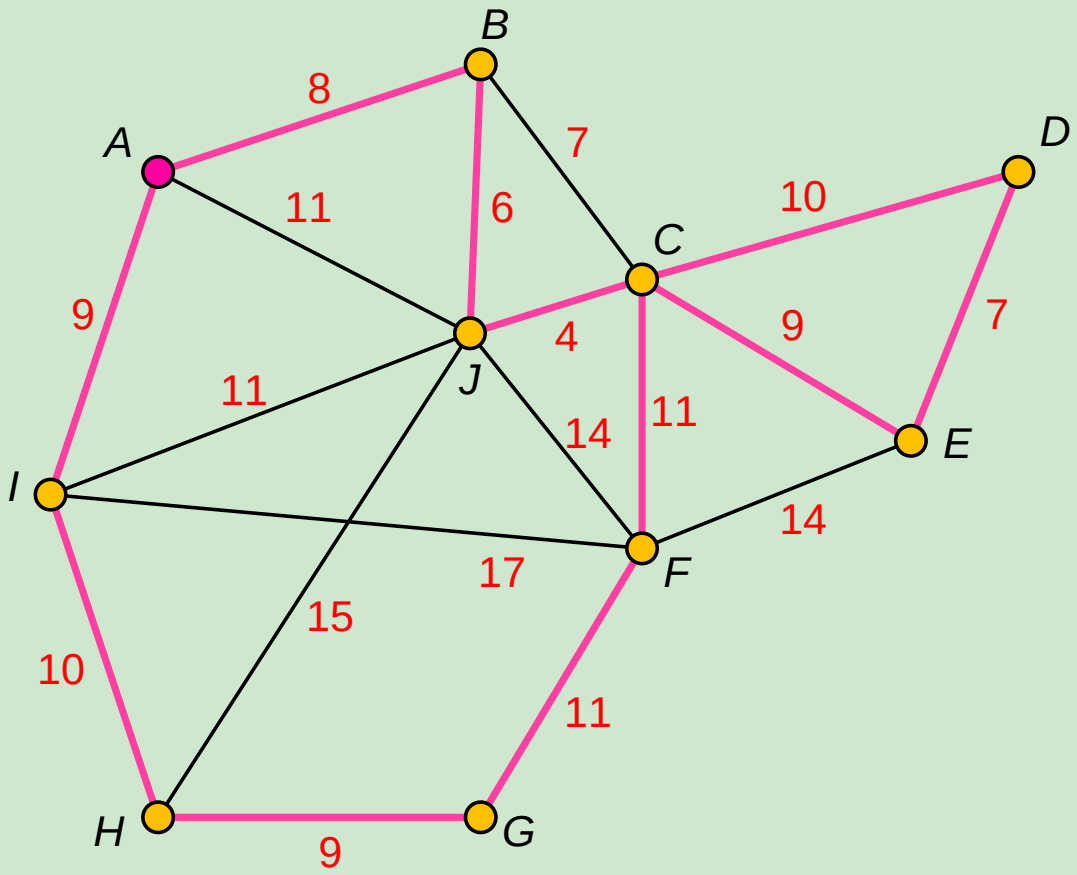


The Nearest-Neighbor Algorithm

Example (Nearest-Neighbor Algorithm)

- We ended up with the circuit *ABJCEDFGHIA*.
- The length is 94 miles.
- Is it possible to do better?

Outline

The Repetitive Nearest-Neighbor Algorithm

Definition (Repetitive Nearest-Neighbor Algorithm)

The Repetitive Nearest-Neighbor Algorithm applies the nearest-neighbor algorithm repeatedly, using each of the vertices as a starting point. It selects the starting point that produced the shortest circuit.

The Repetitive Nearest-Neighbor Algorithm

Example (Repetitive Nearest-Neighbor Algorithm)

- Re-do the previous example, starting at city *B*.
- Re-do the previous example, starting at city *C*.
- Did we get a better solution?

Outline

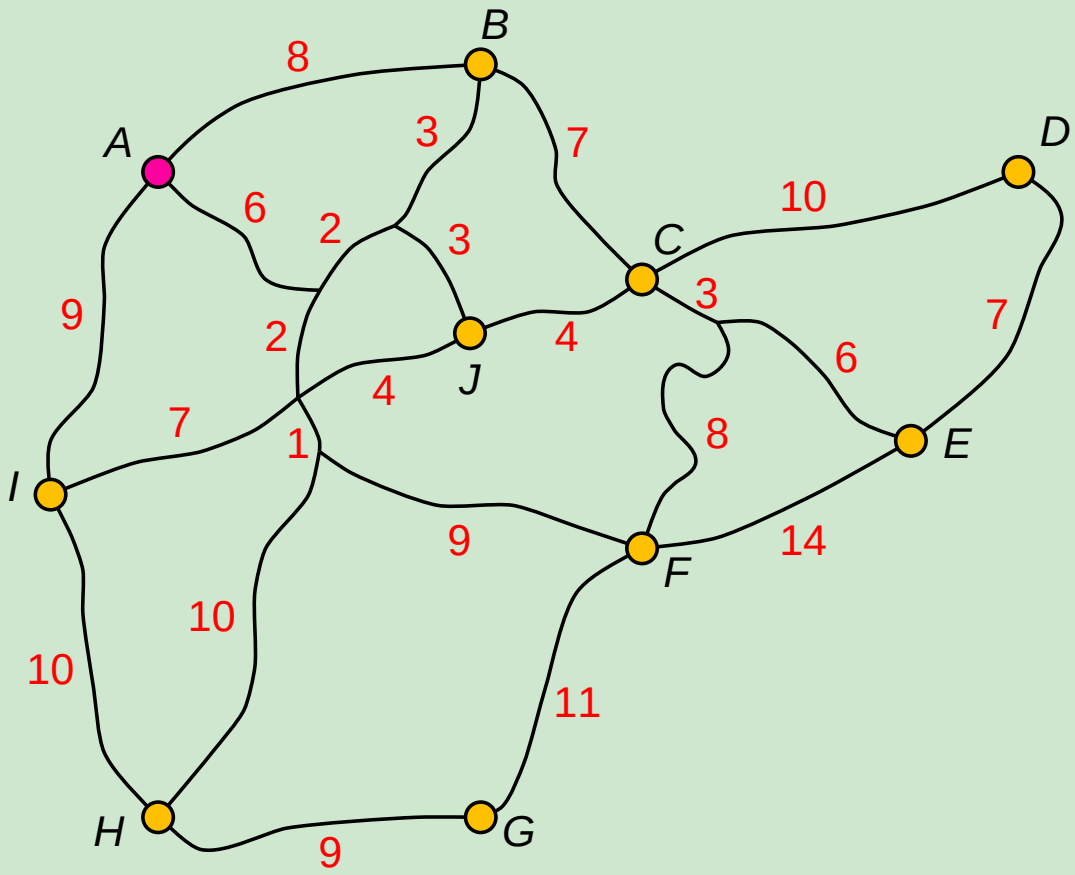
The Cheapest-Link Algorithm

Definition (Cheapest-Link Algorithm)

The Cheapest-Link Algorithm begins with the edge of least weight and makes it part of the circuit. Then it selects the edge of second-smallest weight, and so on. Once a vertex has two selected edges, no more edges of that vertex are considered and we must avoid creating a circuit prematurely. Eventually the edges will form a circuit.

Example

Example (Cheapest-Link Algorithm)



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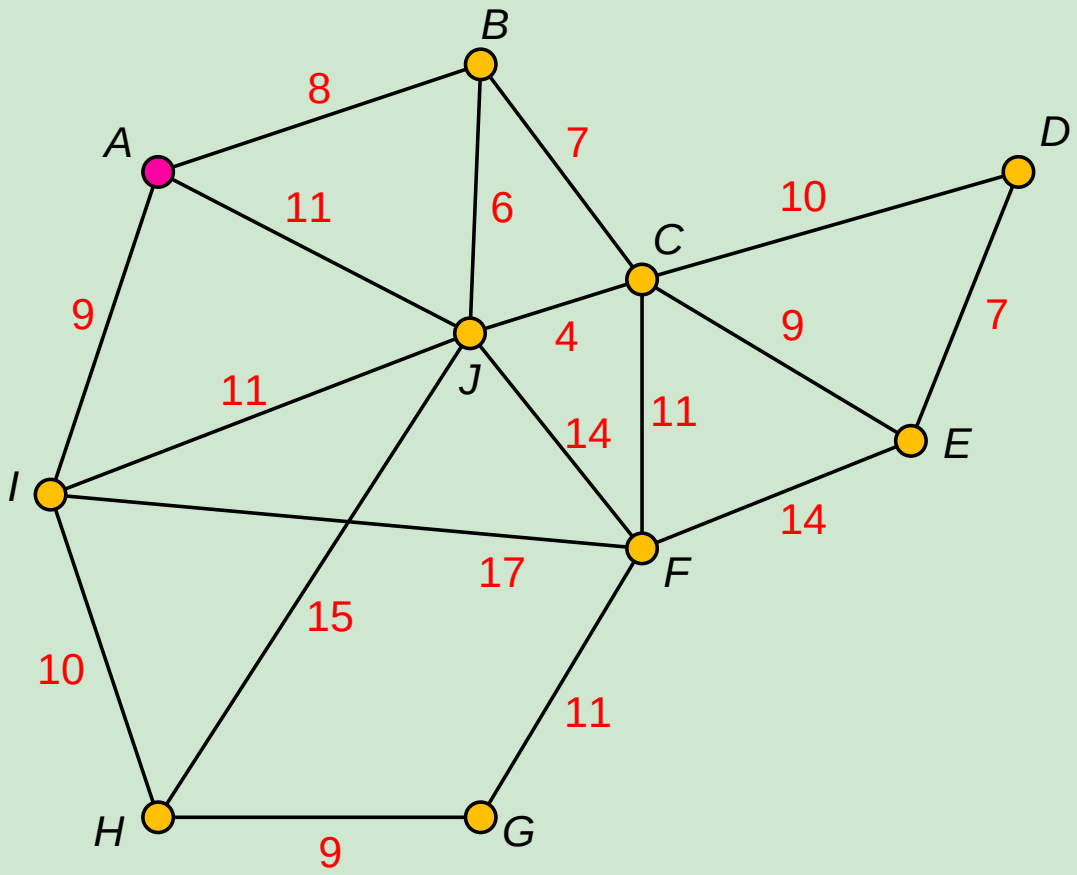

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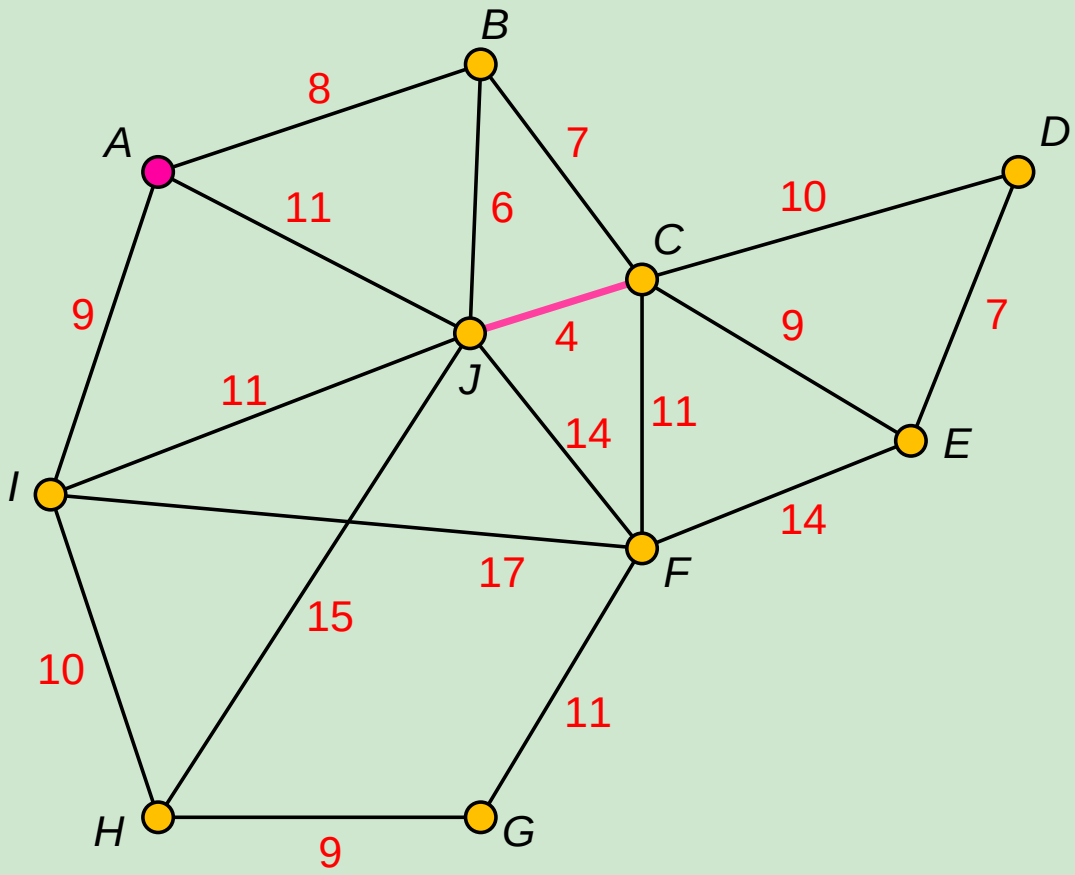

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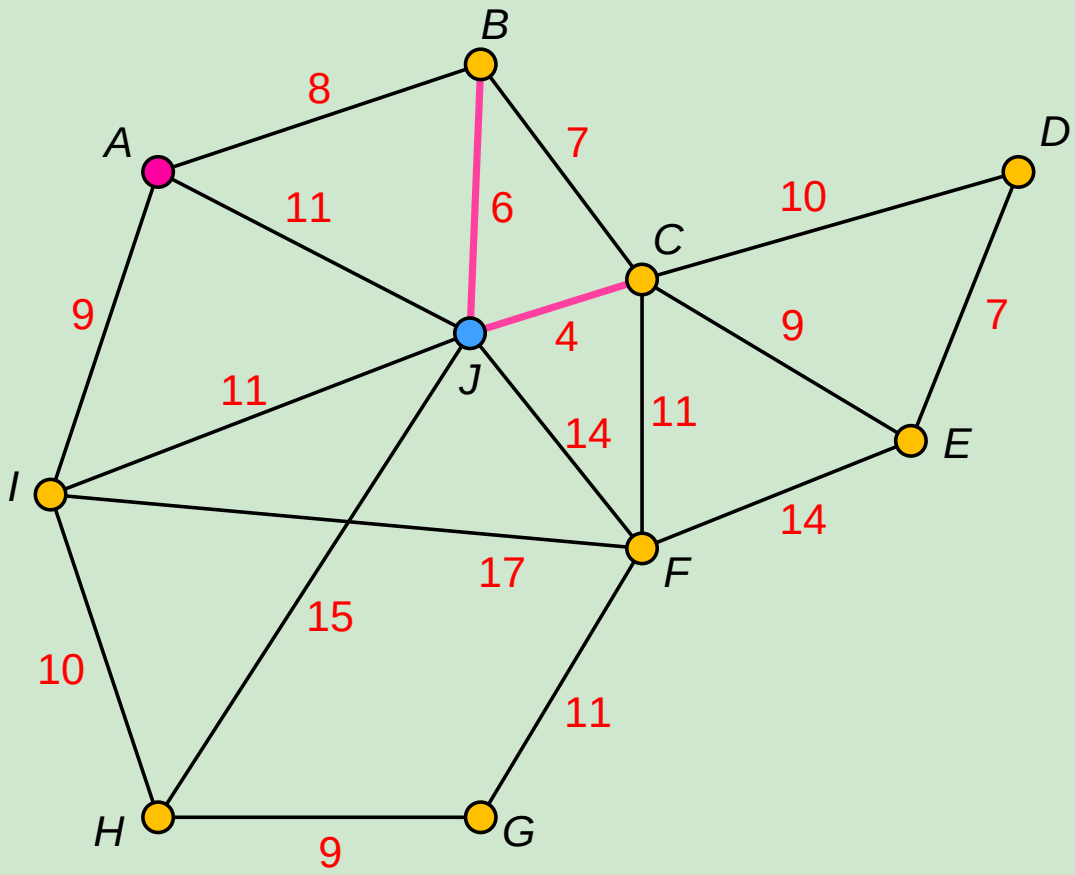

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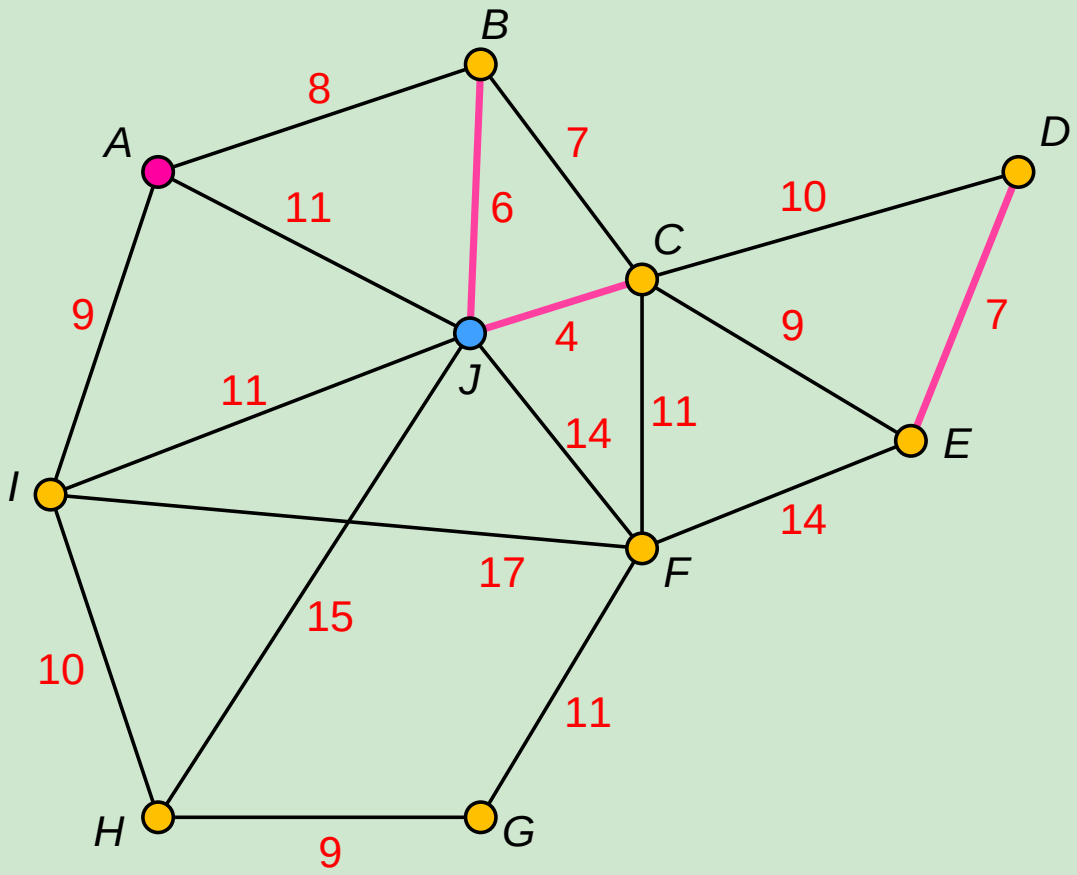

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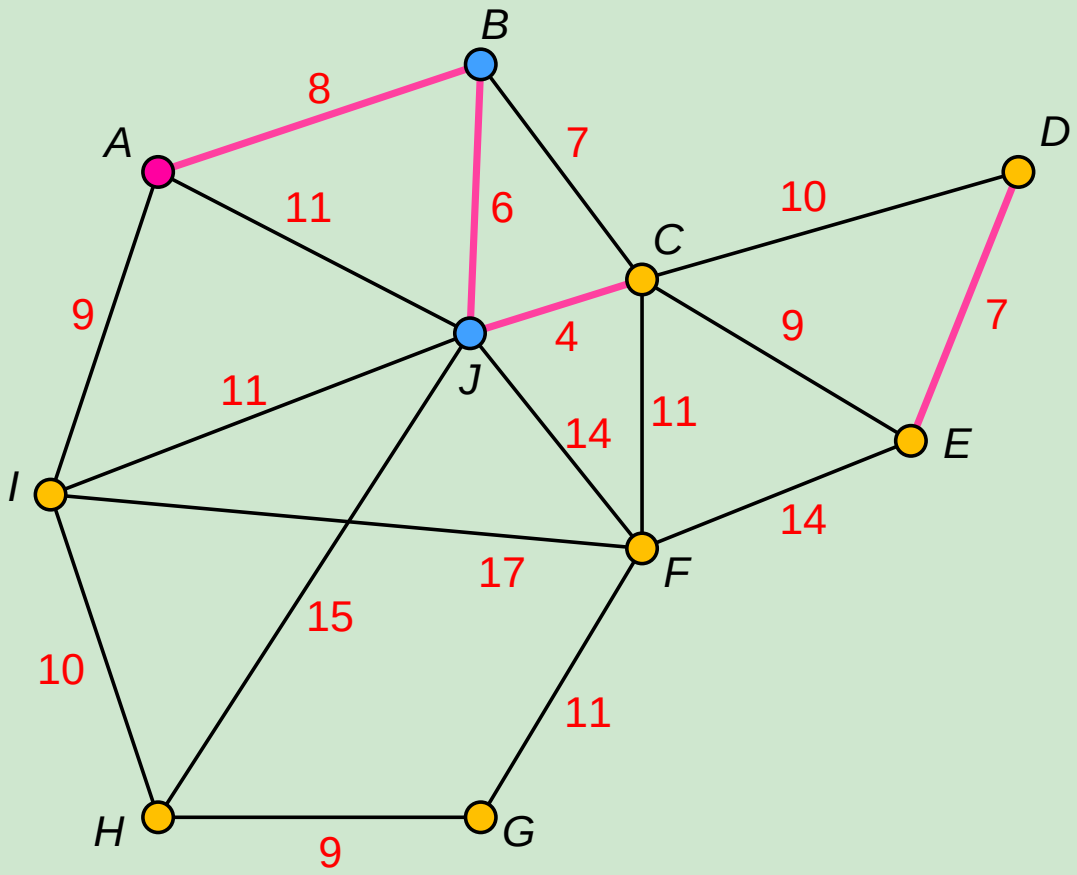

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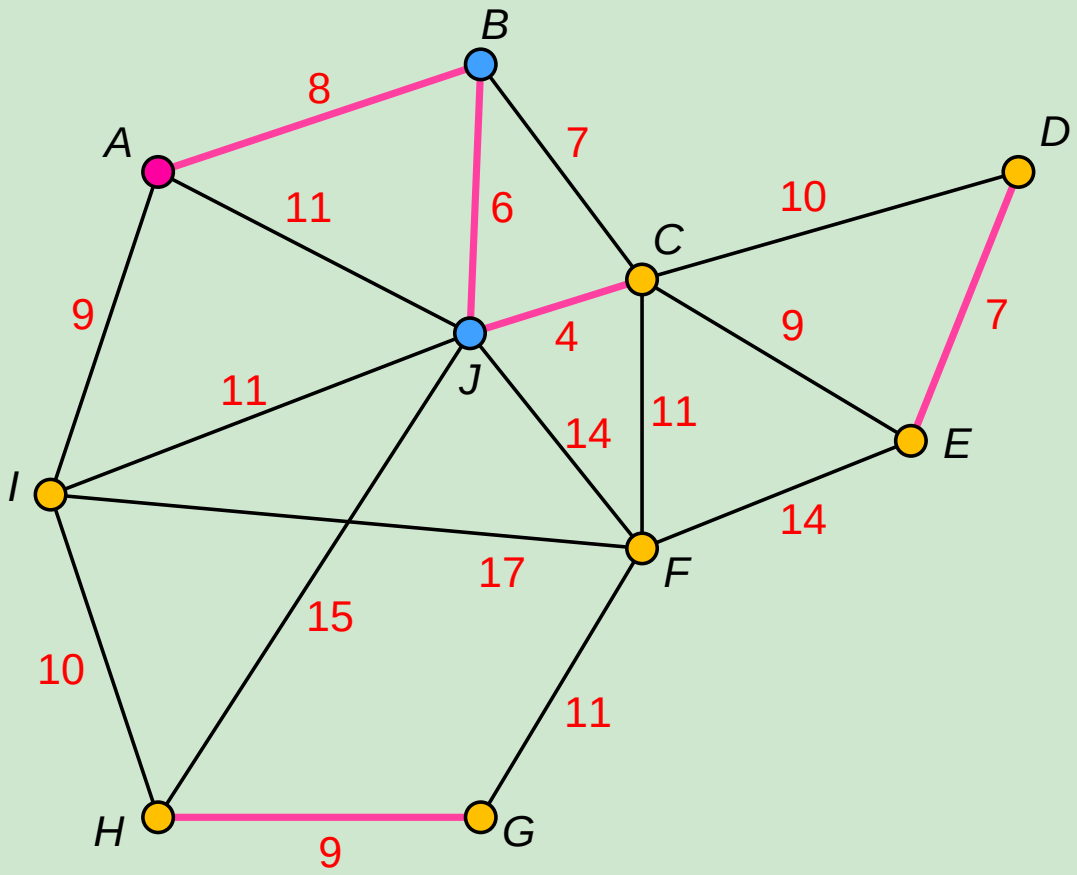

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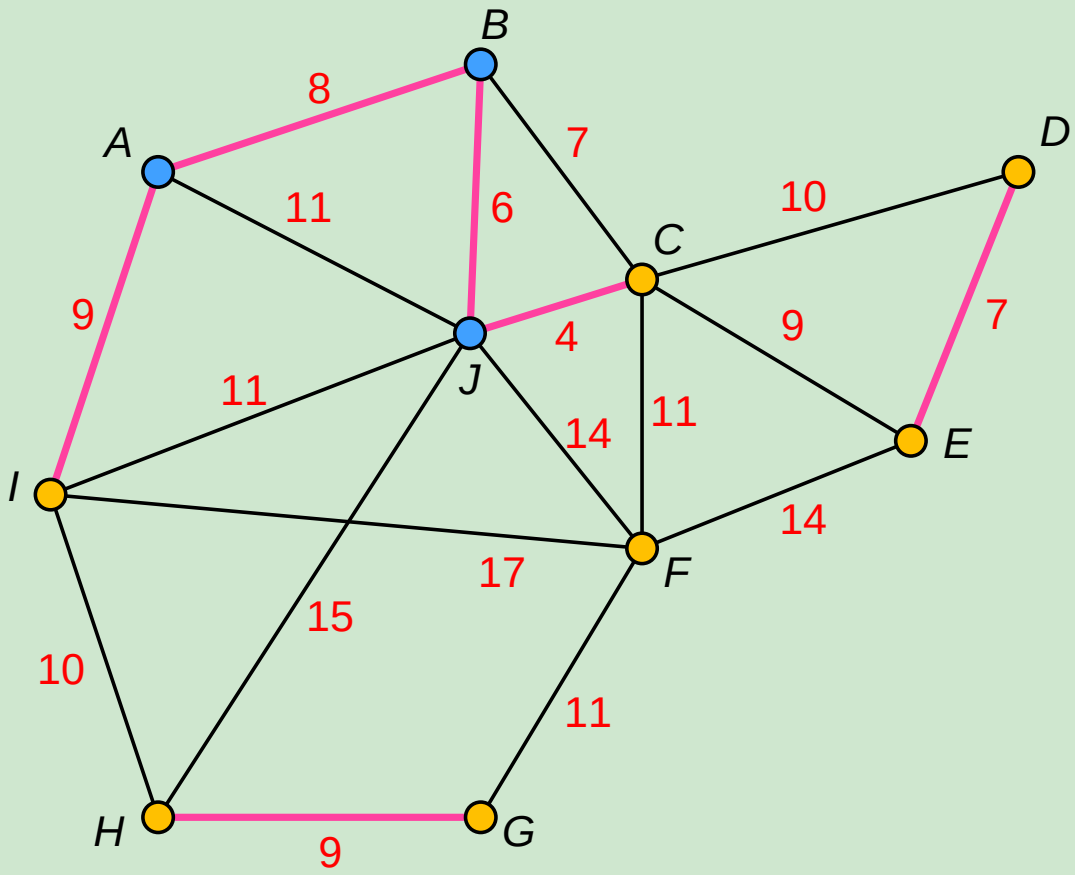

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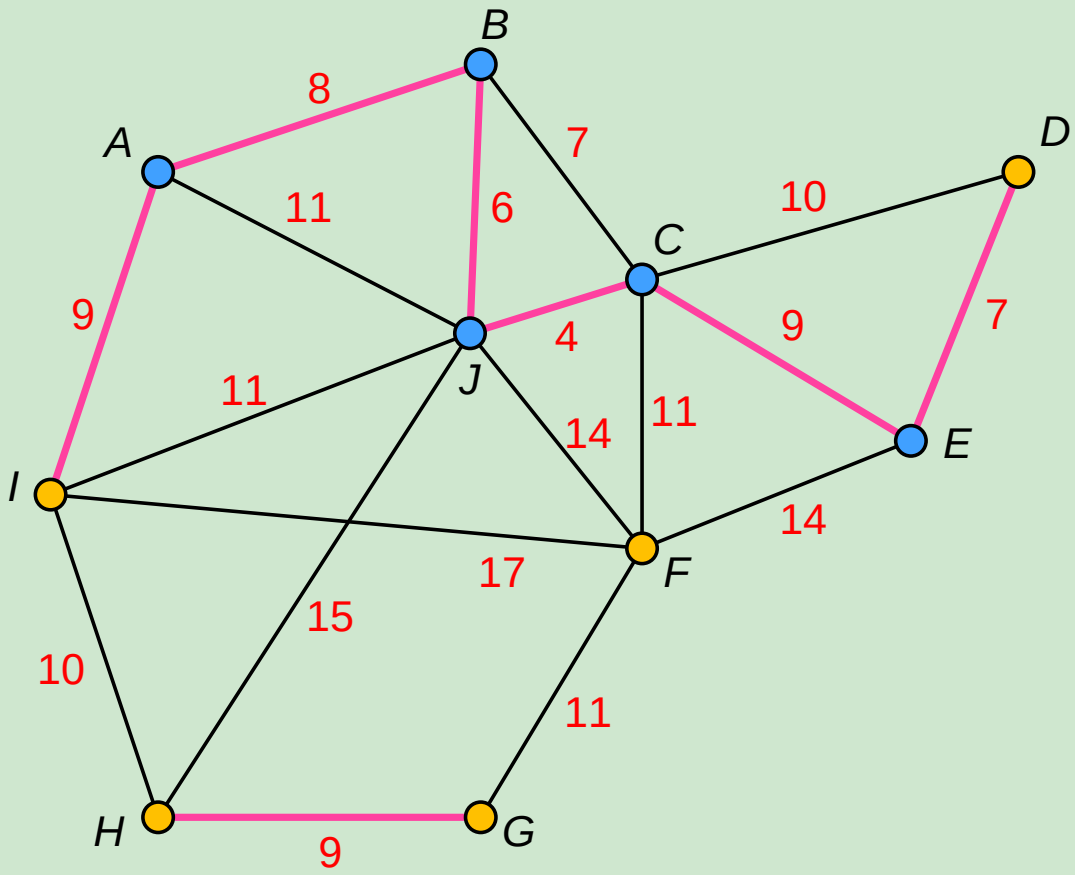

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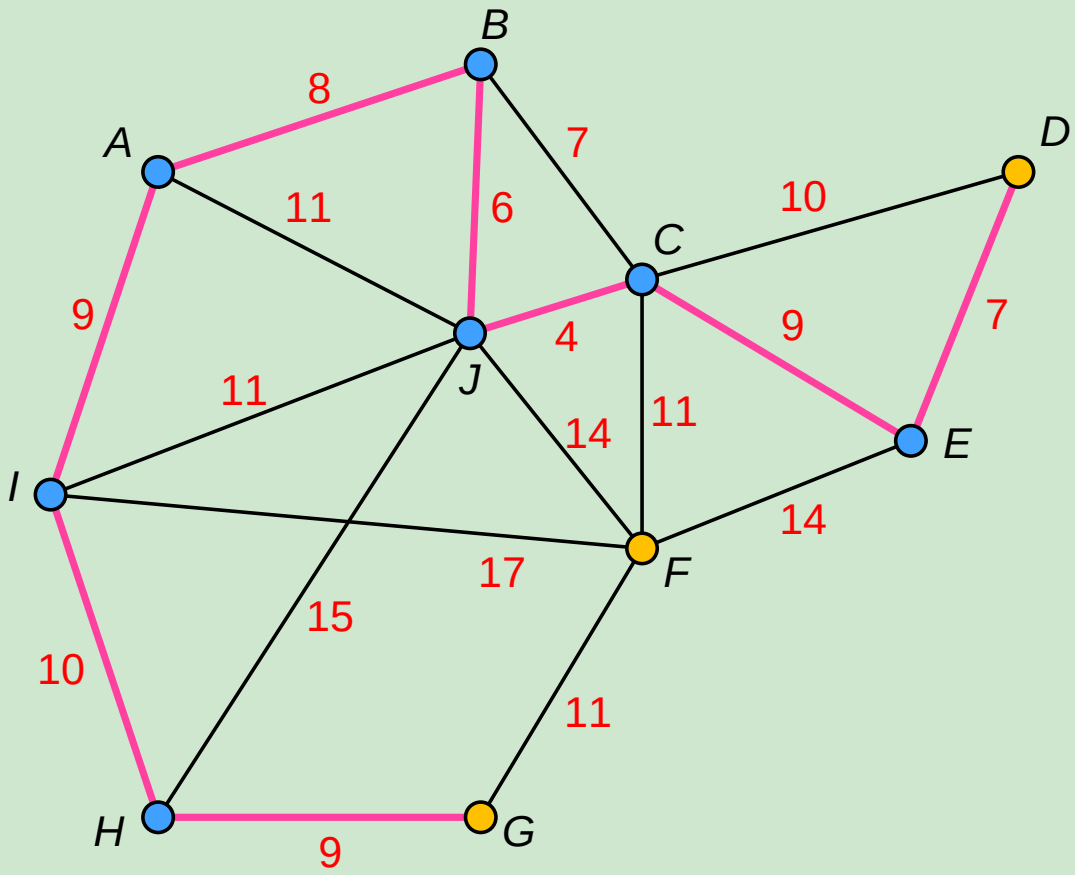

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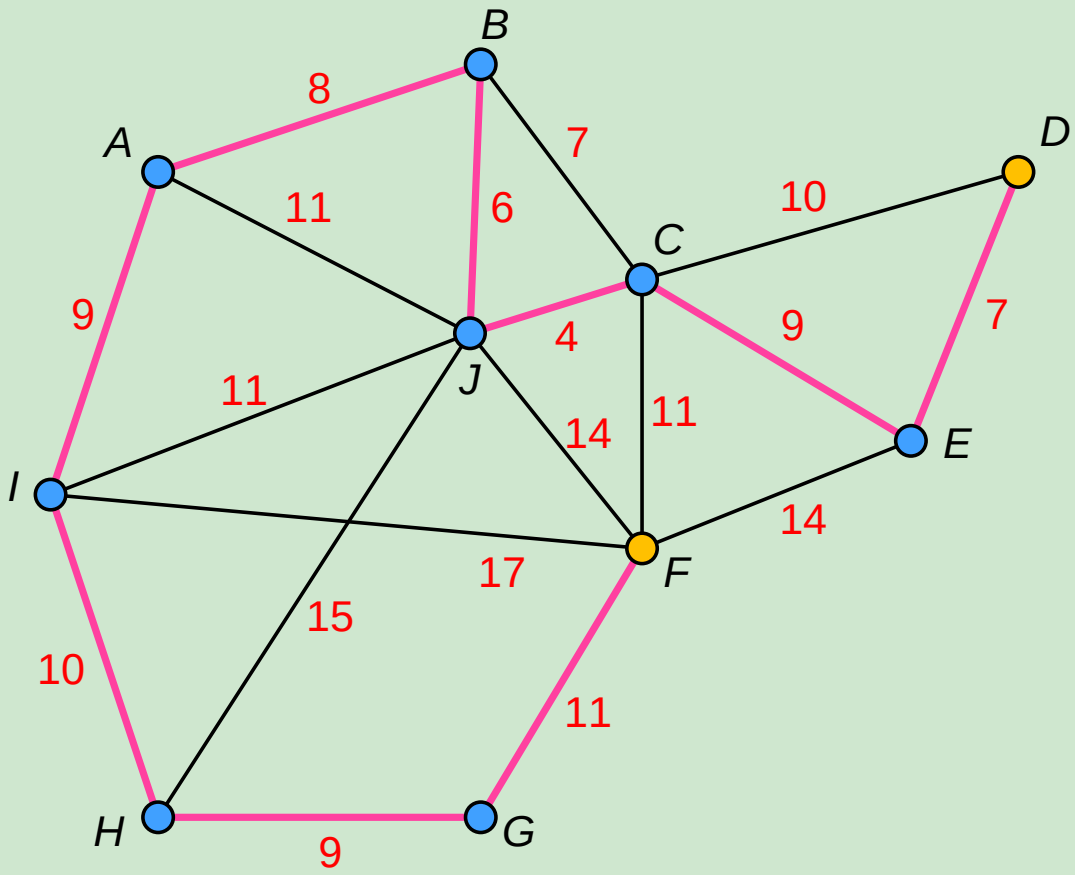

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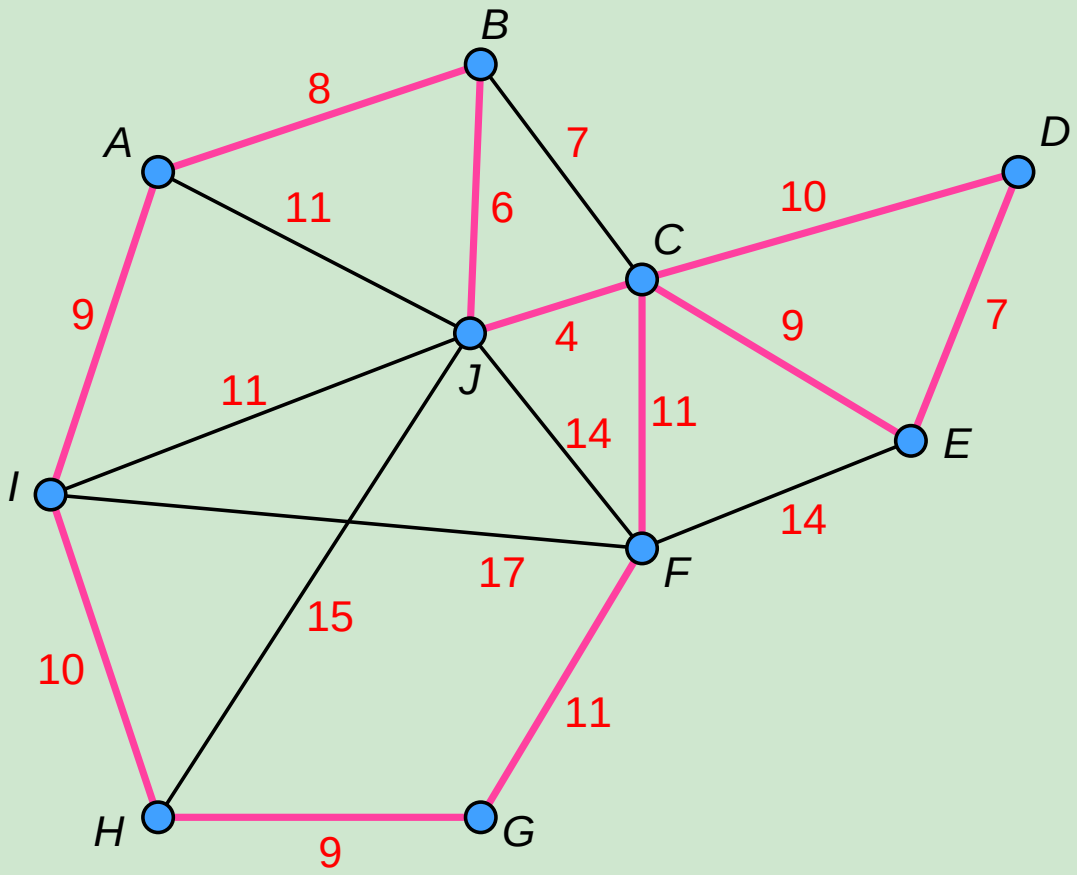
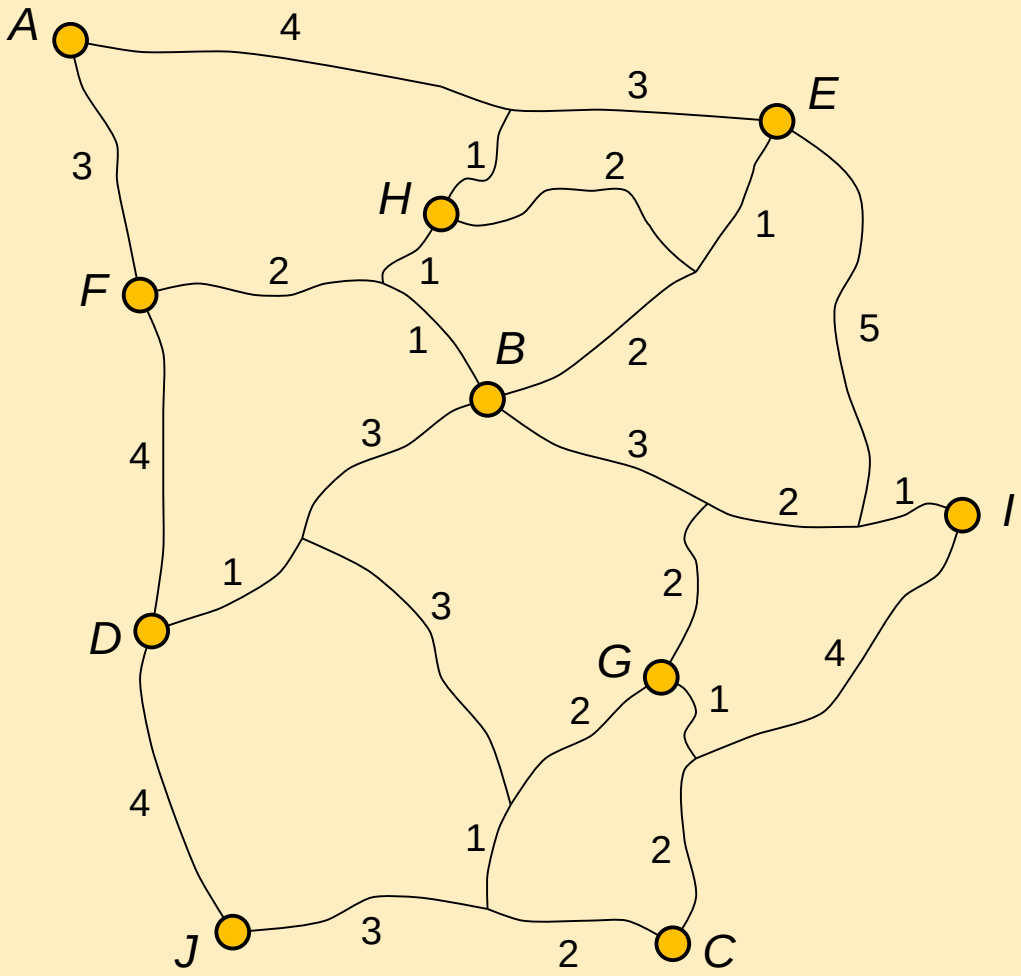


Worksheet



Worksheet