Network Analysis

网络分析

INFORMATION ENGINEERING UNIVERSITY

中国人民解放军战略支援部队信息工程大学—李翔讲师

PLA Strategic Support Force Information Engineering University——Lecturer. Xiang Li

- 长期从事地理信息系统与地理空间数据库的教学与科研工作。
- 研究方向：地理信息辅助定位、网络空间数据建模等。讲授课程包括《地理空间数据库》、《地理信息数据处理程序设计》、《地理信息系统设计与开发》等。
- 获全国高校GIS专业青年教师讲课竞赛特等奖，获战略支援部队讲课比赛三等奖，主持和参与国家“十三五”重点研发计划、河南省科技攻关、部门科研课题等6项，发表学术和教学论文20余篇，授权发明专利5项，软著2项。

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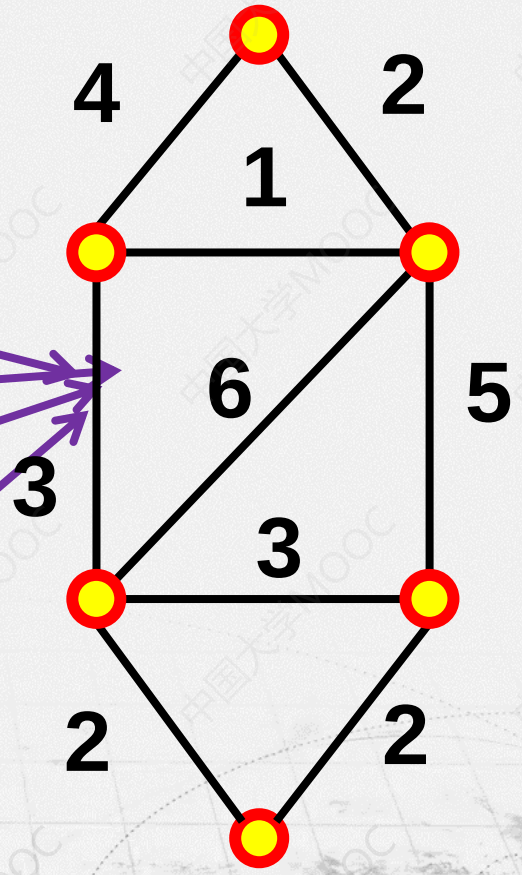
01 Dijkstra 最短路径算法概述

What is Dijkstra shortest path algorithm?

从郑州某仓库到武汉火神山医院怎么走距离最短呢?

01 Dijkstra 最短路径算法概述

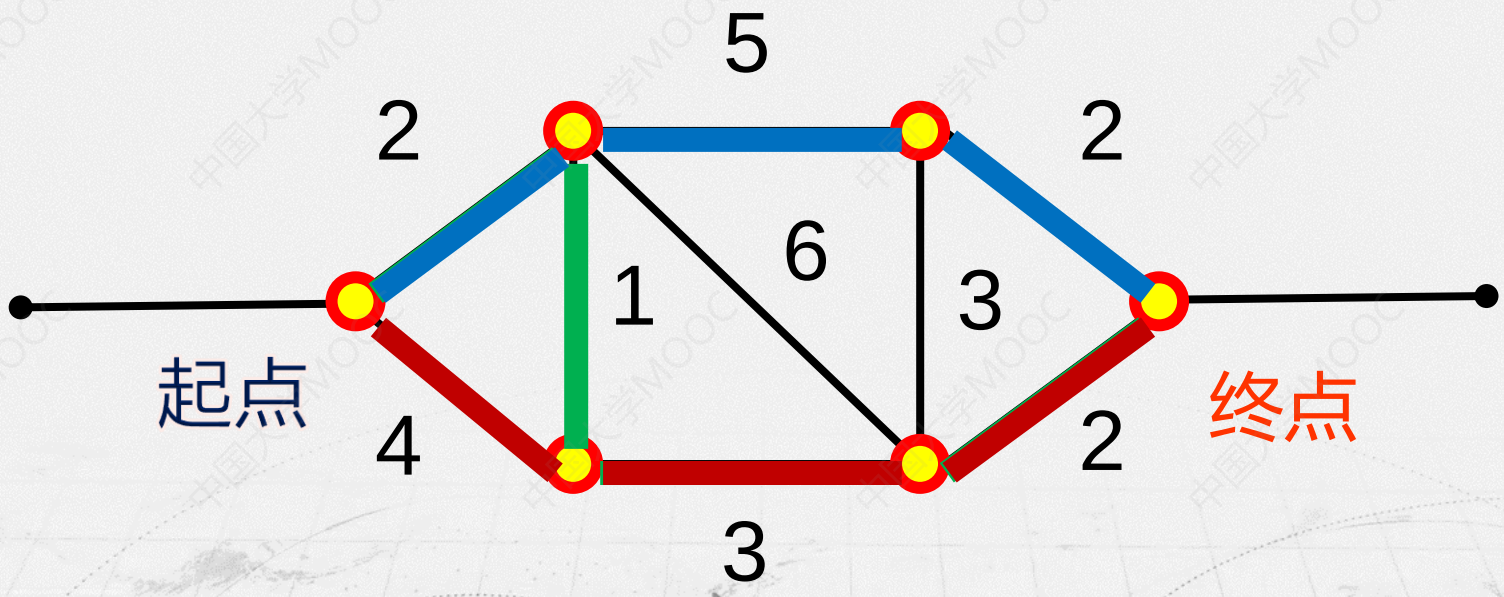
What is Dijkstra shortest path algorithm?



01 Dijkstra 最短路径算法概述

What is Dijkstra shortest path algorithm?

网络中求最短路径：



01 Dijkstra 最短路径算法概述

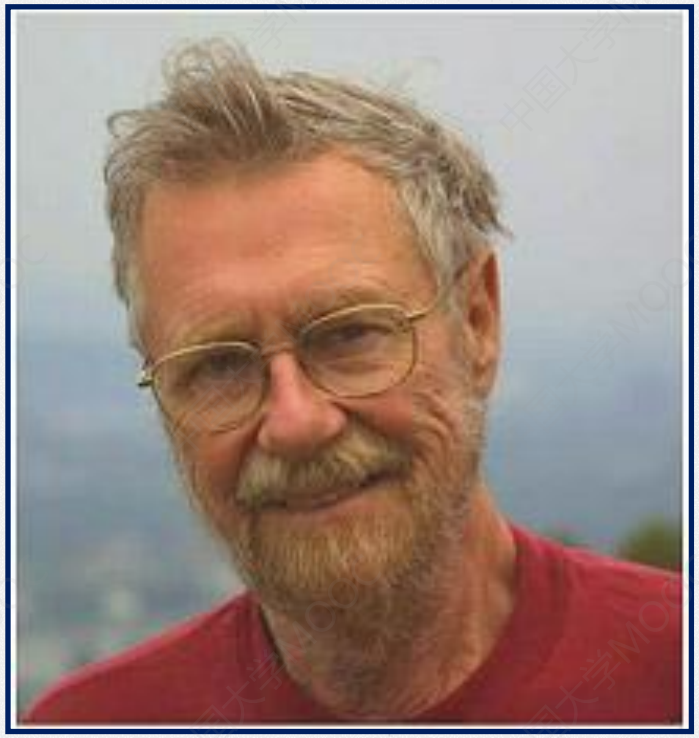
What is Dijkstra shortest path algorithm?

荷兰计算机科学家，毕业就职于荷兰Leiden大学，早年钻研物理及数学，而后转为计算学。Dijkstra算法是他于1959年提出的一种按路径长度递增的次序产生最短路径的算法。

基本原理：

按照最短路径递增的次序，逐次搜索出从起点到网络中其余所有点的最短路径。

图片来自文献【1】



艾兹格·W·迪克斯特拉
Edsger Wybe Dijkstra
(1930.5.11-2002.8.6)

01 Dijkstra 最短路径算法概述

What is Dijkstra shortest path algorithm?

- 给出一个从起点到终止点T的初始路径
- 然后对这条路径不断的优化，使其距离减小
- 当其不能再缩优化时，即为最短路径

01 Dijkstra最短路径算法概述

What is Dijkstra shortest path algorithm?

What is Dijkstra shortest path algorithm?

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1、如何建立初始路径

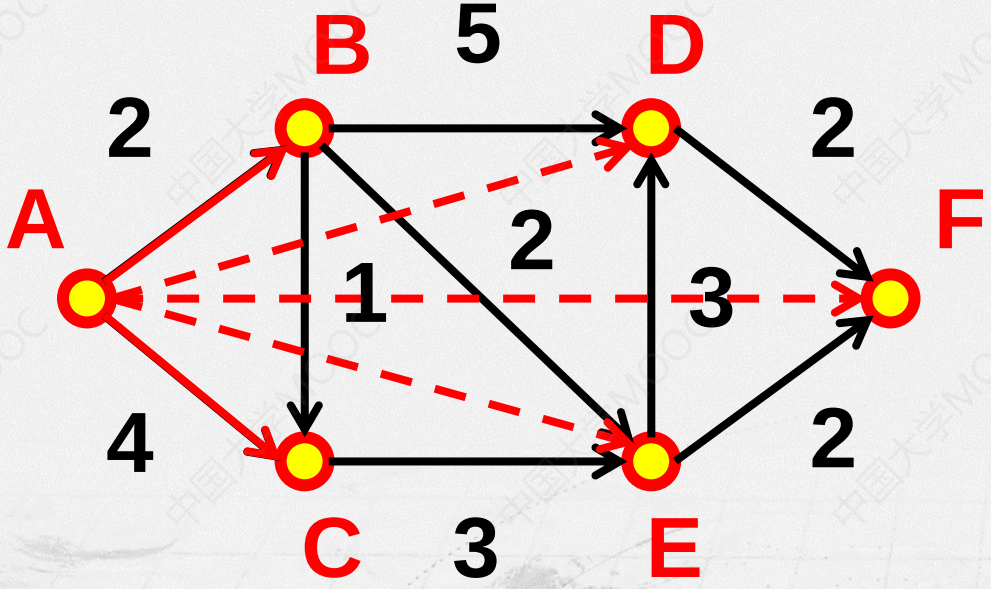
2、如何对一条路径进行优化

3、如何确定这条路径的权值不能被进一步缩短

01 Dijkstra 最短路径算法概述

What is Dijkstra shortest path algorithm?

? 1、如何建立初始路径



初始路径：由起点直达终点的路径。

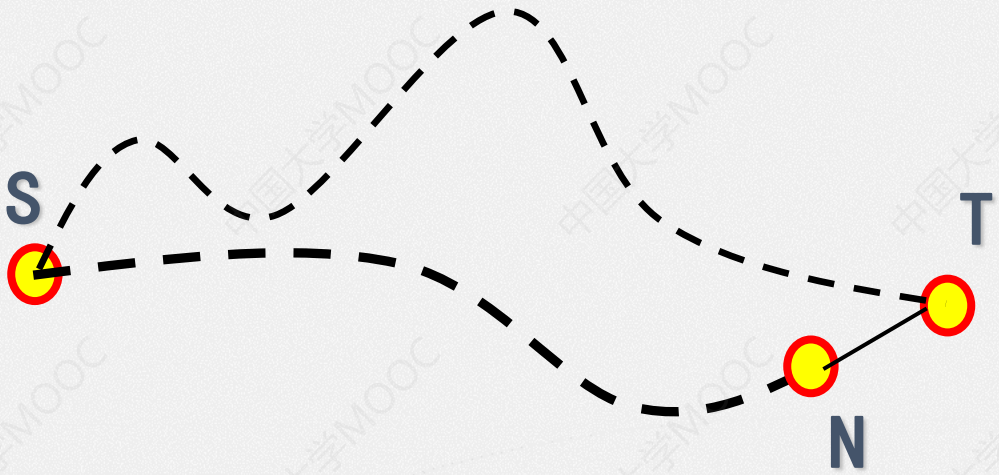
$$M=\{AB, AC, AD, AE, AF\}$$

$$DIS=\{2, 4, \infty, \infty, \infty\}$$

01 Dijkstra 最短路径算法概述

What is Dijkstra shortest path algorithm?

? 2、如何对一条路径进行优化



DIS(SNT)>DIS(ST) ？

01 Dijkstra 最短路径算法概述

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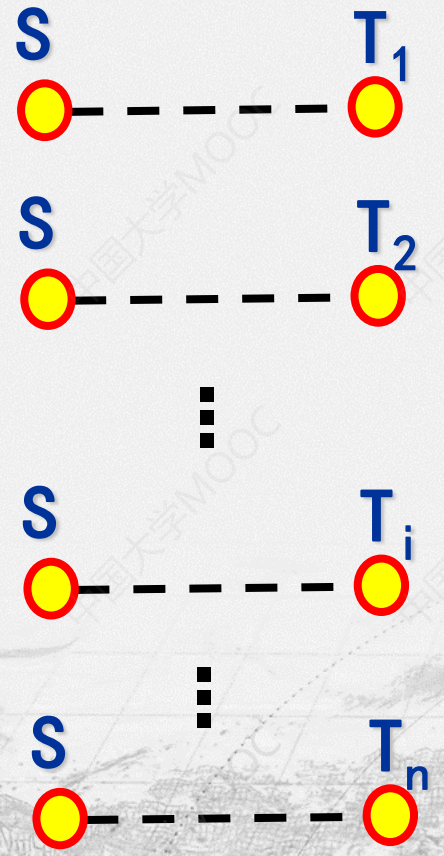
? 3、如何确定这条路径的权值不能被进一步缩短



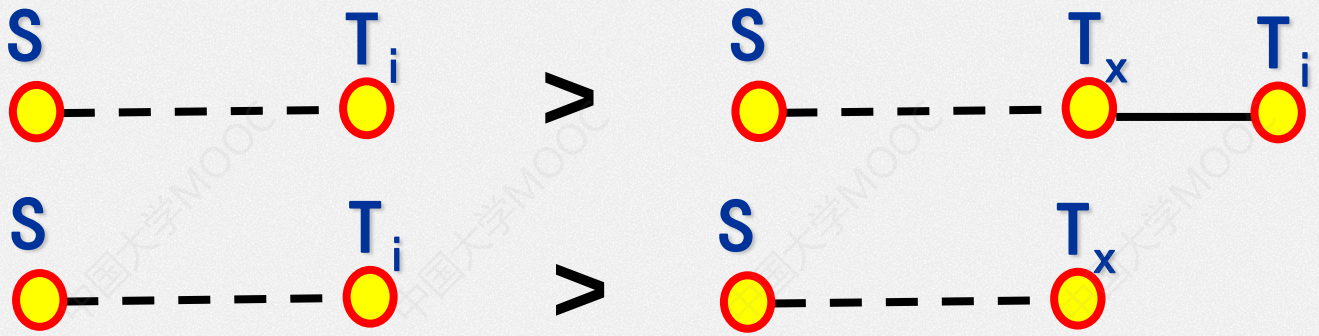
M

$DIS(ST_i)=MIN$

01 Dijkstra 最短路径算法概述

What is Dijkstra shortest path algorithm?

3、如何确定这条路径的权值不能被进一步缩短



在M中按权值从小到大逐次取出的最短路径

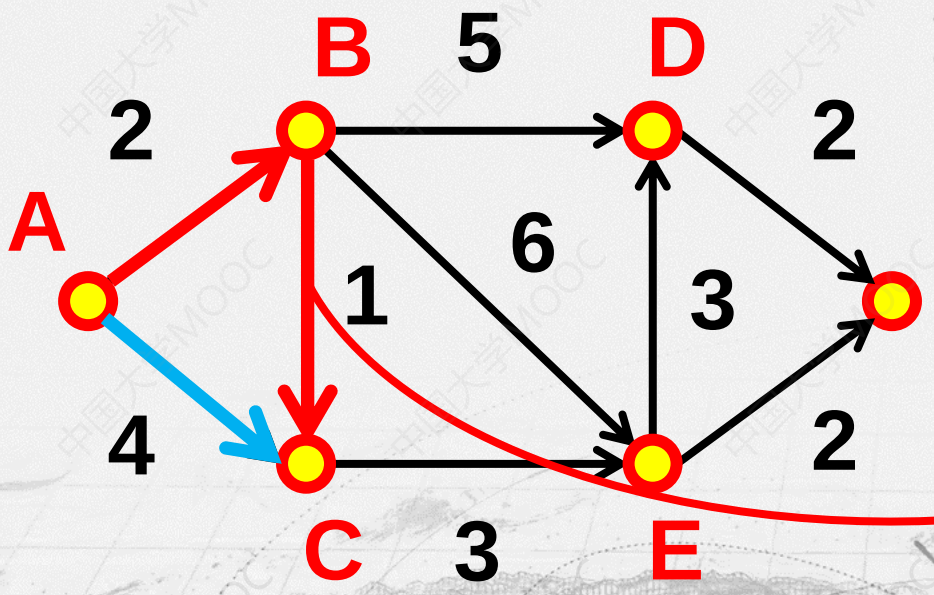
网络中任意边的权值不能小于0


Dijkstra 最短路径算法算例

02 Dijkstra 最短路径算法算例

How does Dijkstra Shortest Path Algorithm Runs?

求解A ->F的最短路径



M = { AB, AC, AD, AE, AF }

PREED = { A , A , A , A , A }

DIS = { 2 , 4 , ∞, ∞, ∞ }

DIS(AB)+ DIS(BC) = 3

DIS(AC) = 3 Λ

DIS(AC) = 4

02 Dijkstra 最短路径算法算例

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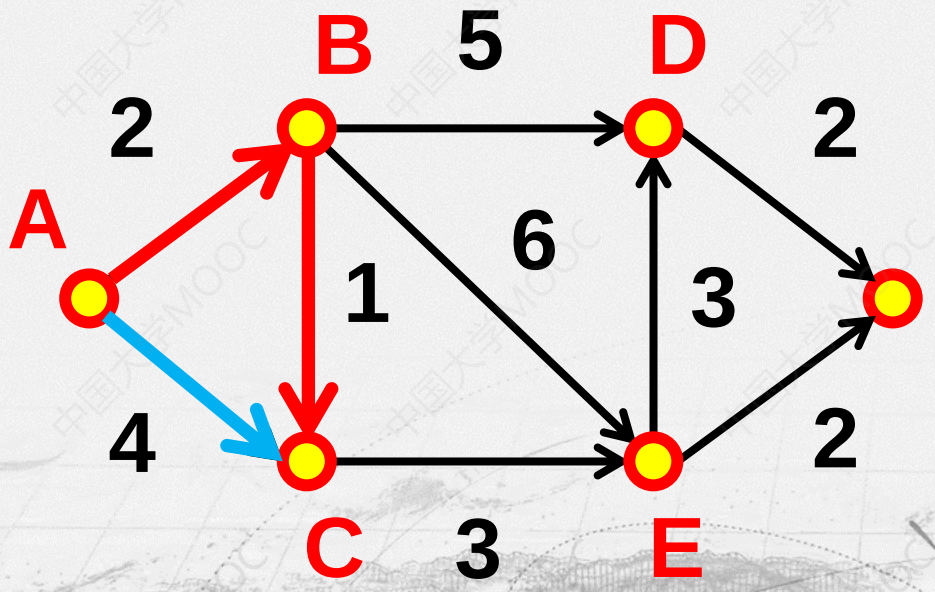

M = { AB, AC, AD, AE, AF }

PREED = { A , B , A, A , A }

DIS = { 2 , 3 , ∞, ∞, ∞ }

DIS(AC) = 3

02 Dijkstra 最短路径算法算例

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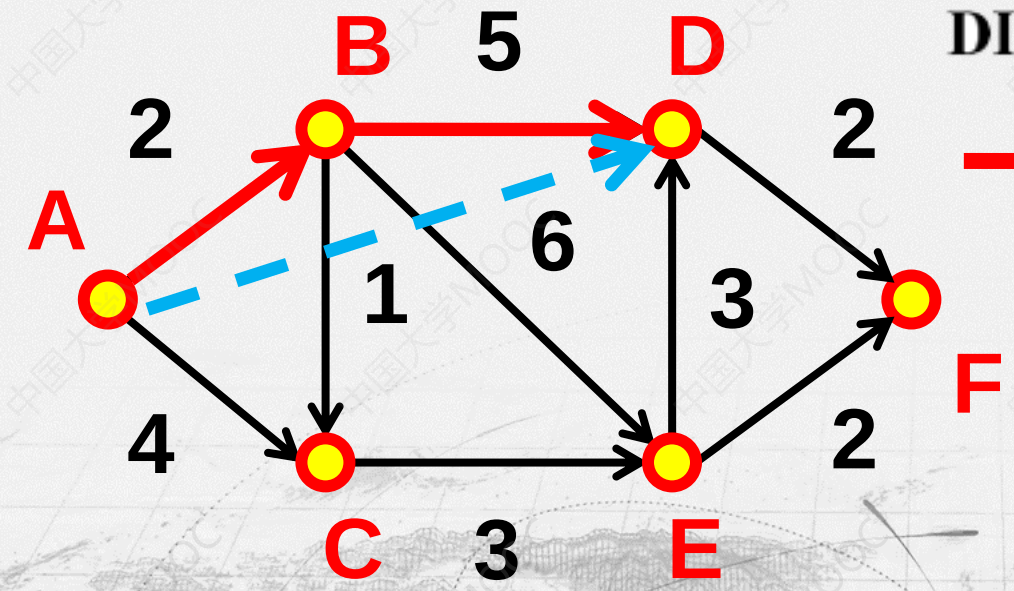

M = { AB, AC, AD, AE, AF }

PREED = { A , B , B, A , A }

DIS = { 2 , 3 , 7, ∞ , ∞ }

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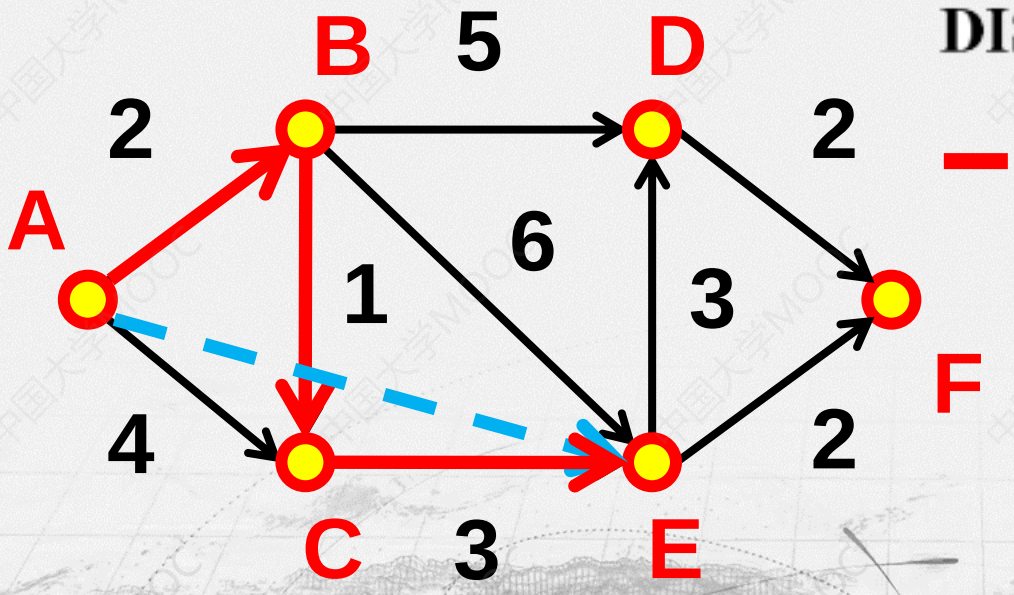

M = { AB, AC, AD, AE, AF }

PREED = { A , B , B, B , A }

DIS = { 2 , 3 , 7, 8 , ∞ }

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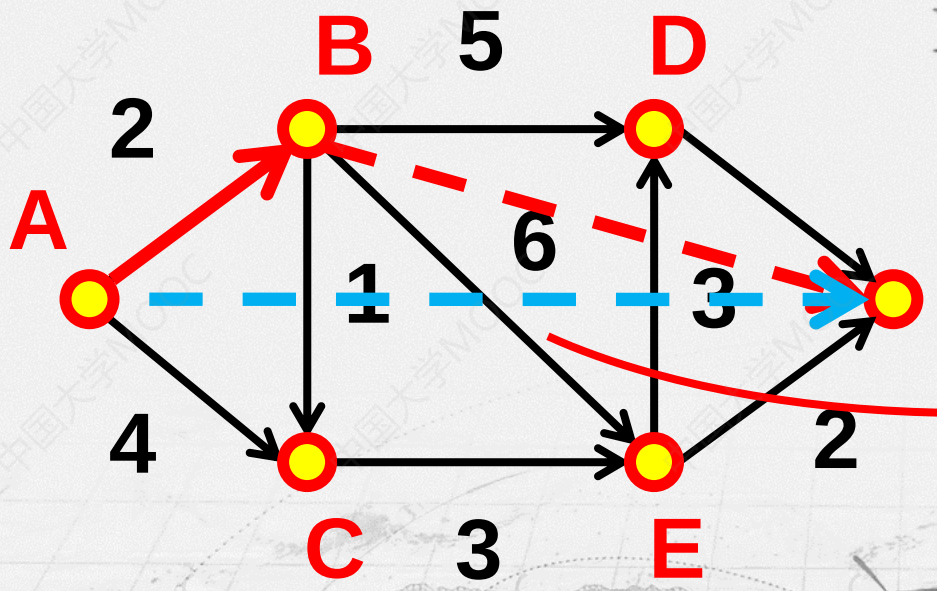

M = { AB, AC, AD, AE, AF }

PREED = { A , B , B , B , A }

DIS = { 2 , 3 , 7 , 8 , ∞ }

DIS(AB)+ DIS(BF) = ∞

无法直接优化！

02 Dijkstra 最短路径算法算例

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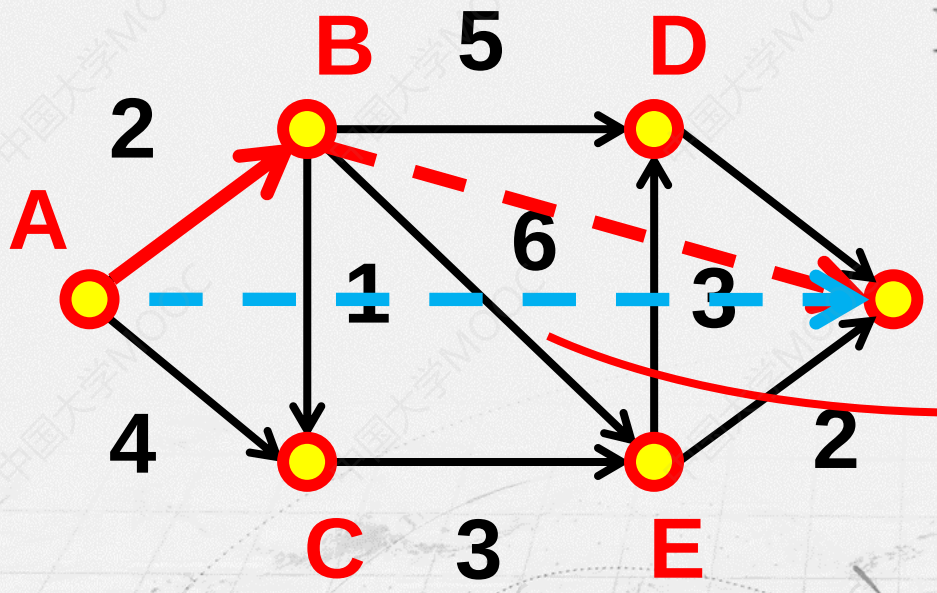
求解A ->F的最短路径



M = { AB, AC, AD, AE, AF }

PREED = { A , B , B , B , A }

DIS = { 2 , 3 , 7 , 8 , ∞ }

DIS(AB)+ DIS(BF) = ∞

无法直接优化！

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How does Dijkstra Shortest Path Algorithm Runs?

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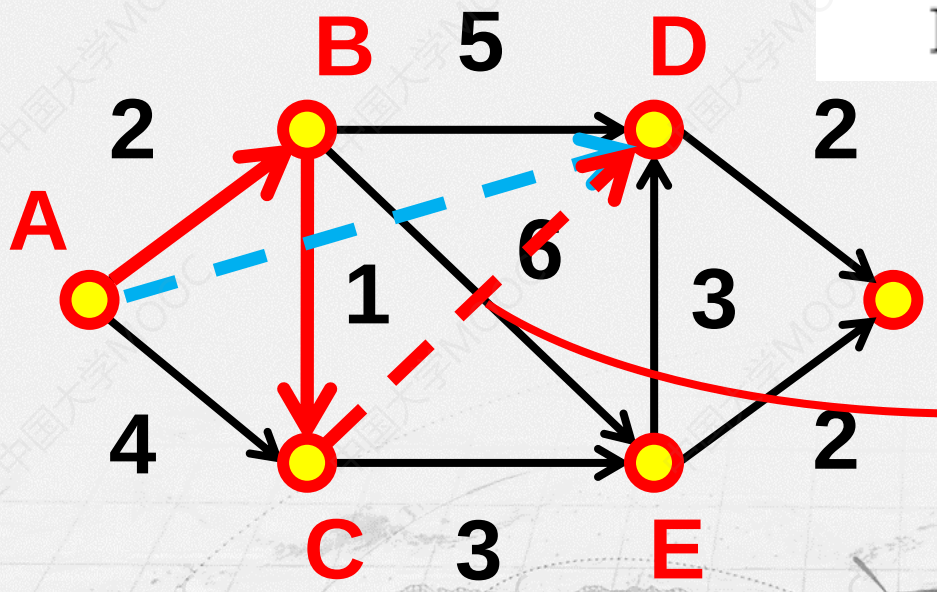

M = { AB, AC, AD, AE, AF }

PREED = { A , B , B , B , A }

DIS = { 2 , 3 , 7, 8 , ∞ }

DIS(AC) + DIS(CD) = ∞

无法直接优化！

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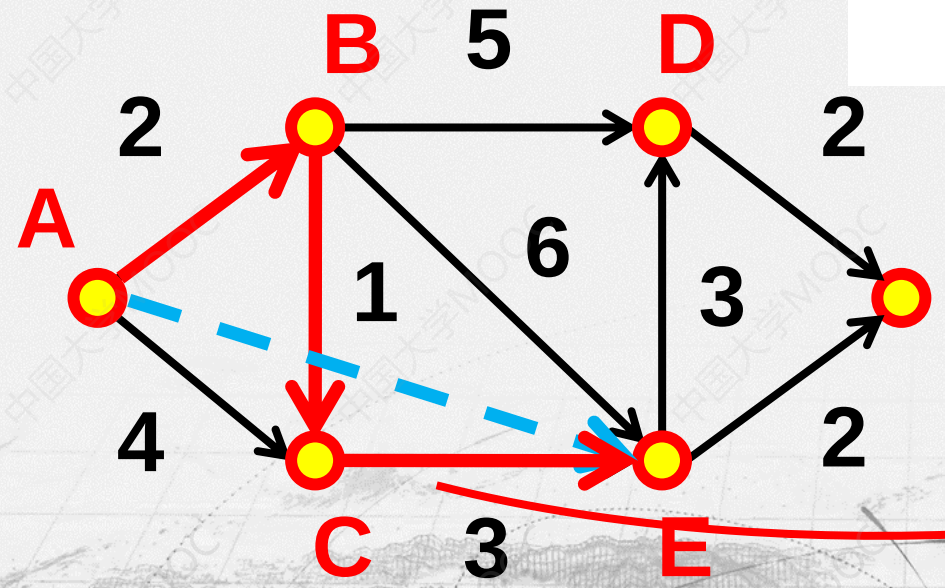

M = { AB, AC, AD, AE, AF }

PREED = { A , B , B , B , A }

DIS = { 2 , 3 , 7 , 8 , ∞ }

DIS(AC) + DIS(C)= 6

DIS(AE) = A

DIS(AE) = 8

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How does Dijkstra Shortest Path Algorithm Runs?

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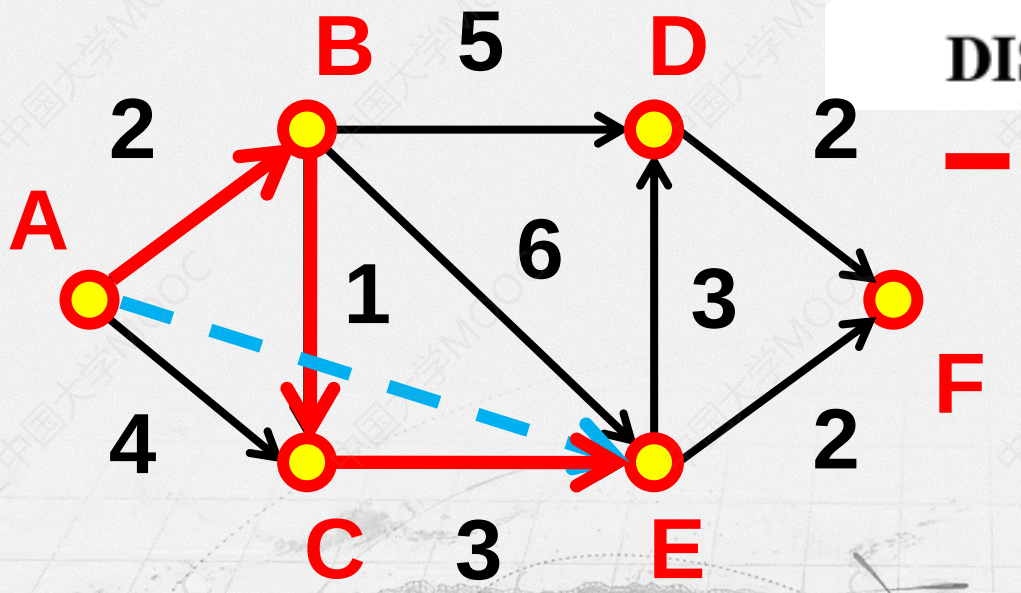

M = {AB, AC, AD, AE, AF}

PREED = { A , B , B , C , A }

DIS = { 2 , 3 , 7 , 6 , ∞ }

DIS(AE) = 6

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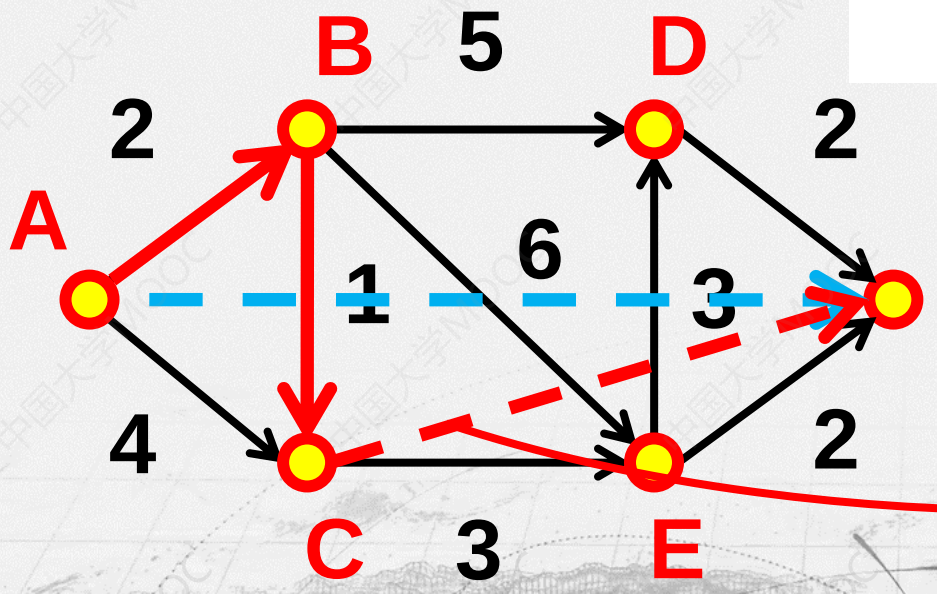

M = { AB, AC, AD, AE, AF }

PREED = { A , B , B , C , A }

DIS = { 2 , 3 , 7 , 6 , ∞ }

DIS(AC) + DIS(CF)= ∞

无法直接优化！

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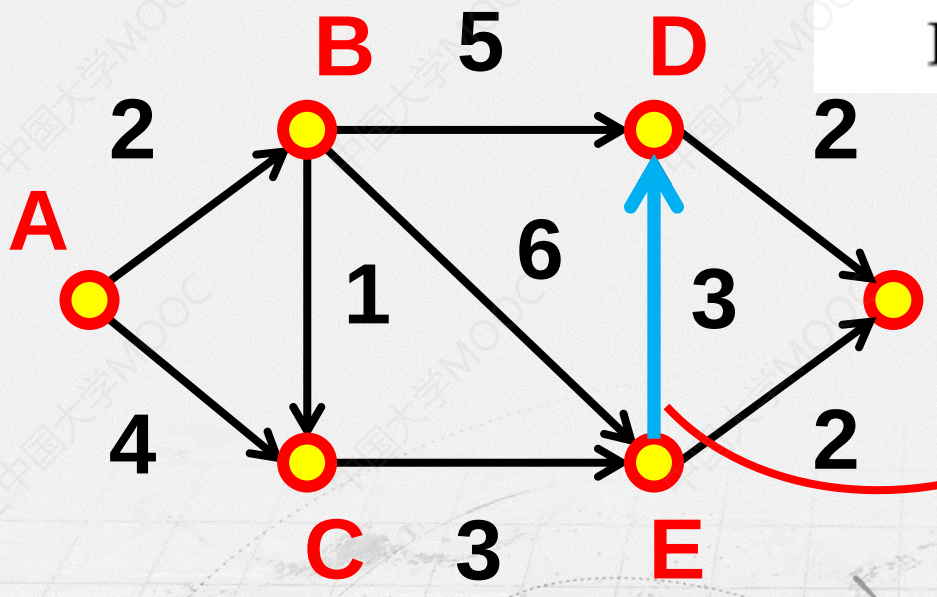


M = { AB, AC, AD, AE, AF }

PREED = { A , B , B , C , A }

DIS = { 2 , 3 , 7 , 6 , ∞ }

DIS(DE) + DIS(AE) = 9

V

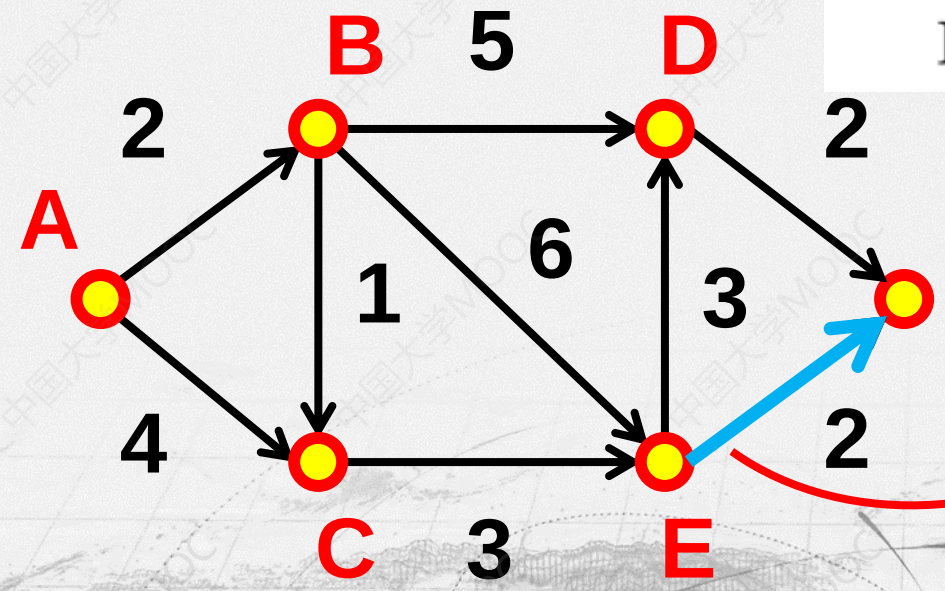
DIS(AD) = 7

无需优化！

02 Dijkstra 最短路径算法算例

How does Dijkstra Shortest Path Algorithm Runs?

求解A ->F的最短路径



M = { AB, AC, AD, AE, AF }

PREED = { A , B , B , C , A }

DIS = { 2 , 3 , 7 , 6 , ∞ }

DIS(EF) + DIS(AE) = 8

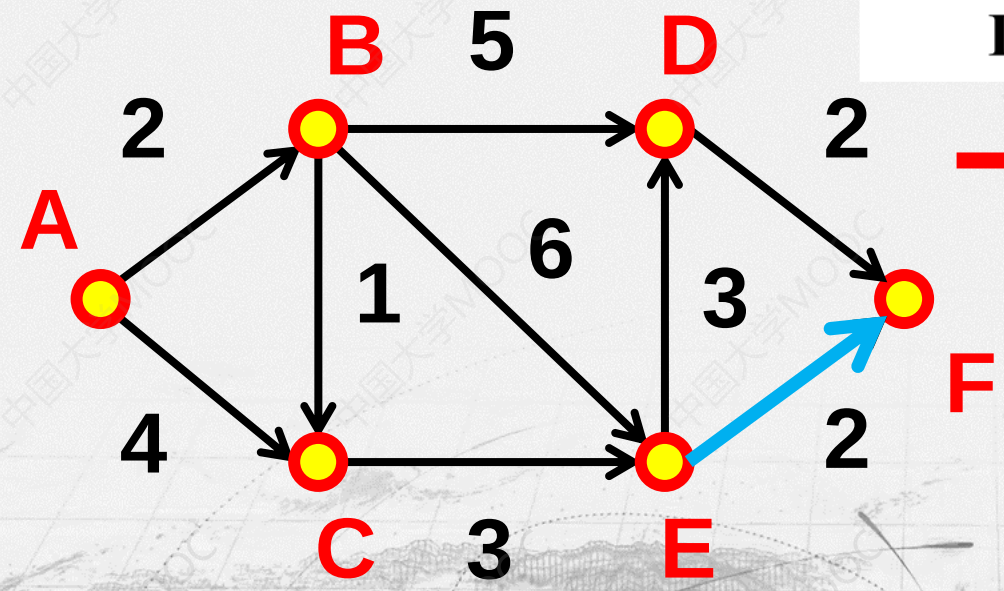
∧

DIS(AF) = ∞

02 Dijkstra 最短路径算法算例

How does Dijkstra Shortest Path Algorithm Runs?

求解A ->F的最短路径



M = { AB, AC, AD, AE, AF }

PREED = { A , B , B , C, E }

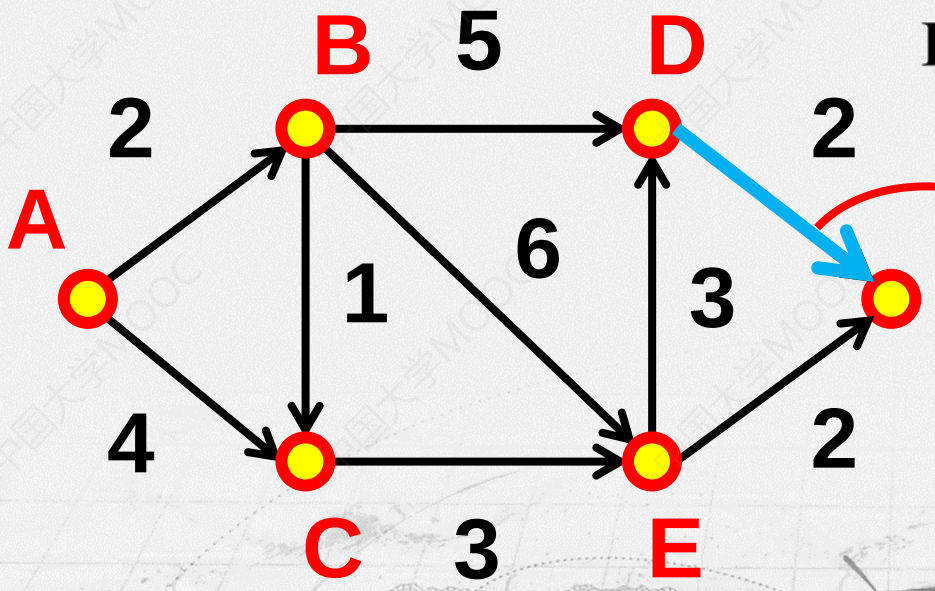
DIS = { 2 , 3 , 7 , 6, 8 }

DIS(AF) = 8

02 Dijkstra 最短路径算法算例

How does Dijkstra Shortest Path Algorithm Runs?

求解A ->F的最短路径



M = { AB, AC, AD, AE, AF }

PREED = { A , B , B , C, E }

DIS = { 2 , 3 , 7 , 6, 8 }

DIS(DF) + DIS(AD) = 9

V

DIS(AF) = 8

无需优化！

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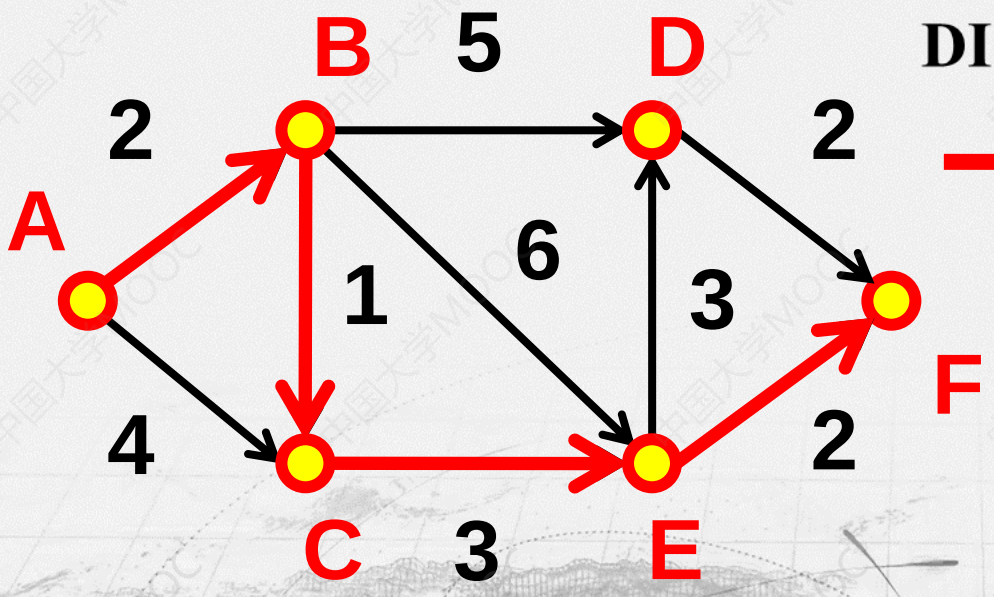
求解A ->F的最短路径



M = { AB, AC, AD, AE, AF }

PREED = { A , B , B , C, E }

DIS = { 2 , 3 , 7 , 6, 8 }

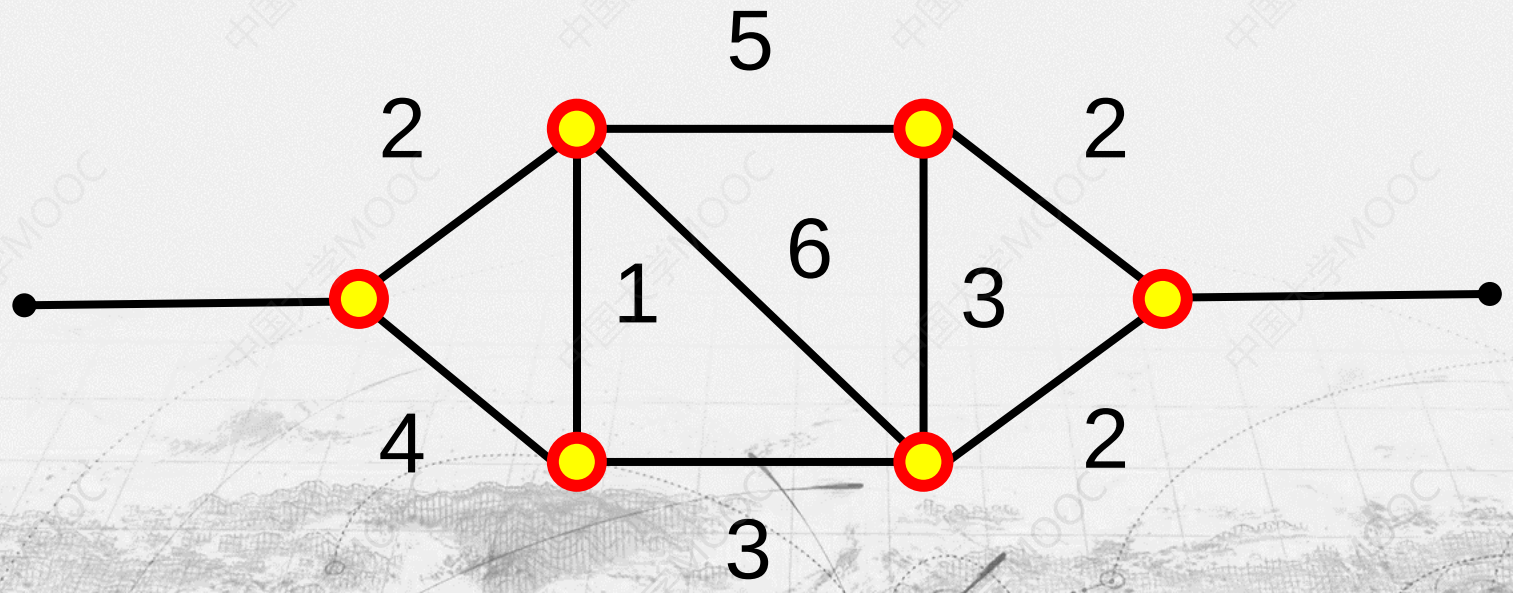
A - B - C - E - F

02 Dijkstra 最短路径算法算例

How does Dijkstra Shortest Path Algorithm Runs?

思考题

- **为什么迪克斯特拉算法中边的权值不能小于0，如果小于0的情况又该如何处理呢?**



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谢 谢 观 看