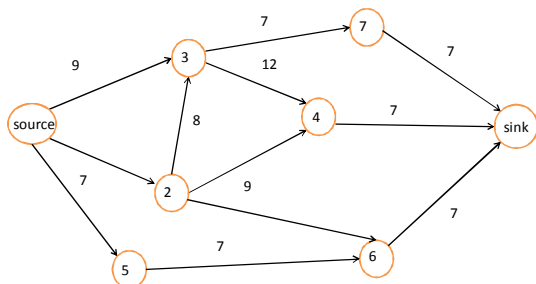


Algorithm for longest path

Generic shortest path algorithm
Single source shortest path algorithm
Bellman-Ford 1958

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Mályusz Levente: Decision Support models

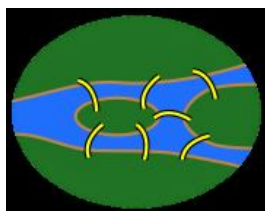
Digraph



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Theorem of Graph

- Leonhard Euler 1707-1783
- Königsbergi hidak 1736



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Shortest Path problem

- Algorithms
 - Ford 1956
 - Bellman 1958
 - Dantzig 1958
 - Dijkstra 1959



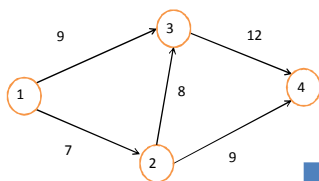
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Graph, network

- 1847 Kirchoff graph theory and application of electrical networks.
- 1852 F. Guthrie: There are four colour problem.
- 1930 Kuratowski planar graph.
- 1956-61 Ford-Fulkerson maximum flow, minimum cost flow
- 1956 Polaris project, DuPont, Rand Corporation, CPM, PERT, MPM, PDM

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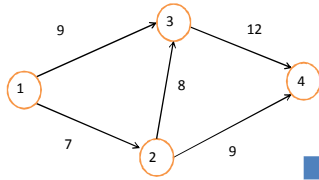
The longest path 1-4, the earliest and latest date policy



	1	2	3	4
1		7	9	
2			8	9
3				12
4				

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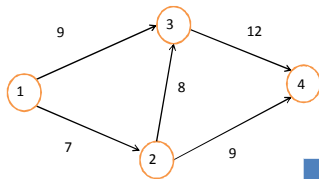
From 1. node



	1	2	3	4
0	1	7	9	
7	2		8	9
9	3			12
	4			

Construction Technology and Management,
Mályusz Levente: Decision Support models

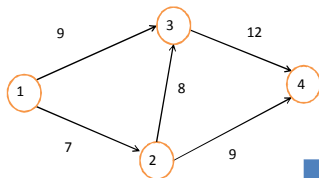
From 2. node



	1	2	3	4
0	1	7	9	
7	2		8	9
9 15	3			12
16	4			

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Mályusz Levente: Decision Support models

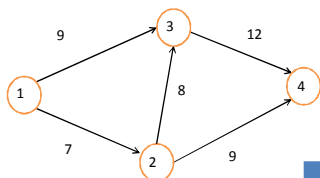
From 3. node



	1	2	3	4
0	1	7	9	
7	2		8	9
9 15	3			12
16 27	4			

Construction Technology and Management,
Mályusz Levente: Decision Support models

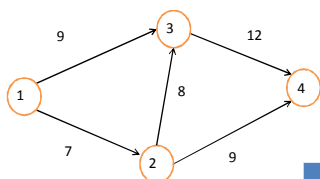
From 1., 2.,3., nodes



	0	1	2	3	4
0	0	1			
7	7		7	9	
15	15			8	9
27	27				12

Construction Technology and Management,
Mályusz Levente: Decision Support models

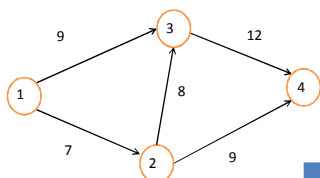
Backward from 4. node



	0	1	2	3	4
0	0	1			
7	7		7	9	
15	15			8	9
27	27				12

Construction Technology and Management,
Mályusz Levente: Decision Support models

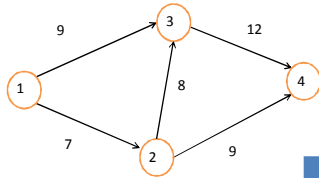
Backward from 3. node



	0	1	2	3	4
0	0	1			
7	7		7	9	
15	15			8	9
27	27				12

Construction Technology and Management,
Mályusz Levente: Decision Support models

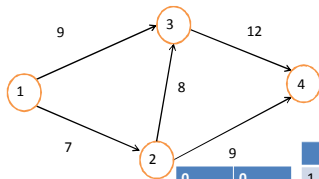
Backward from 2. node



		1	2	3	4
0	0	1	7	9	
7	7	2		8	9
15	15	3			12
27	27	4			
		21	27	9	20
		12			0

Construction Technology and Management,
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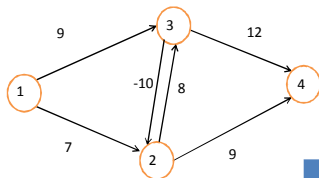
Latest date policy



		1	2	3	4
0	0	1	7	9	
7	7	2		8	9
15	15	3			12
27	27	4			
		21	27	9	20
		12			0

Construction Technology and Management,
Mályusz Levente: Decision Support models

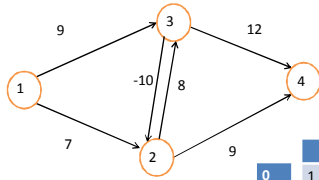
Longest path 1-4 and lag times



	1	2	3	4
1		7	9	
2			8	9
3		-10		12
4				

Construction Technology and Management,
Mályusz Levente: Decision Support models

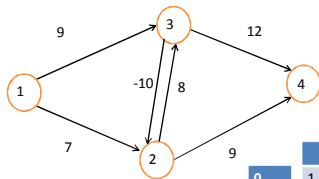
From 1. node



	1	2	3	4
0	1		7	9
7	2		8	9
9	3		-10	12
	4			

Construction Technology and Management,
Mályusz Levente: Decision Support models

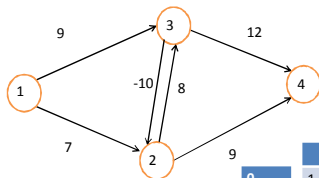
From 2. node



	1	2	3	4
0	1		7	9
7	2		8	9
15	3		-10	12
16	4			

Construction Technology and Management,
Mályusz Levente: Decision Support models

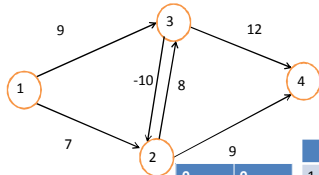
From 3. node



	1	2	3	4
0	1		7	9
7	2		8	9
15	3		-10	12
16 27	4			

Construction Technology and Management,
Mályusz Levente: Decision Support models

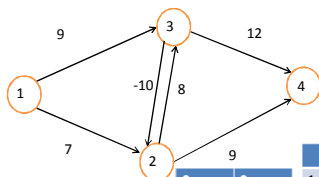
New iteration from 1,2,3. nodes



		1	2	3	4
0	0	1	7	9	
7	7	2		8	9
15	15	3	-10		12
27	16 27	4			

Construction Technology and Management,
Mályusz Levente: Decision Support models

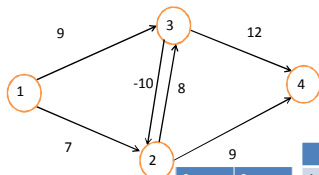
Backward from 4. node



		1	2	3	4
0	0	1	7	9	
7	7	2		8	9
15	15	3	-10		12
27	16 27	4			
			9	12	0

Construction Technology and Management,
Mályusz Levente: Decision Support models

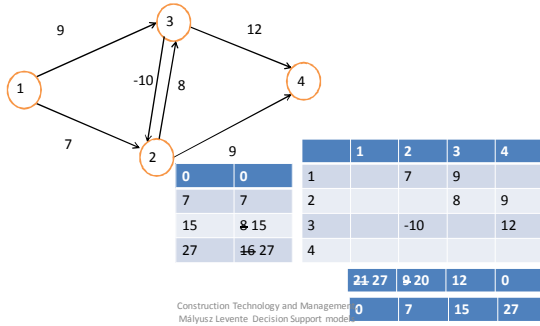
Backward from 3. node



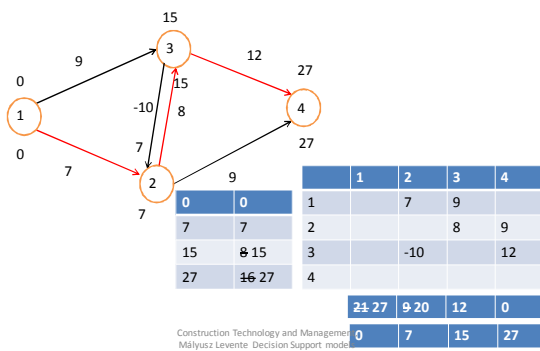
		1	2	3	4
0	0	1	7	9	
7	7	2		8	9
15	15	3	-10		12
27	16 27	4			
		21	9 20	12	0

Construction Technology and Management,
Mályusz Levente: Decision Support models

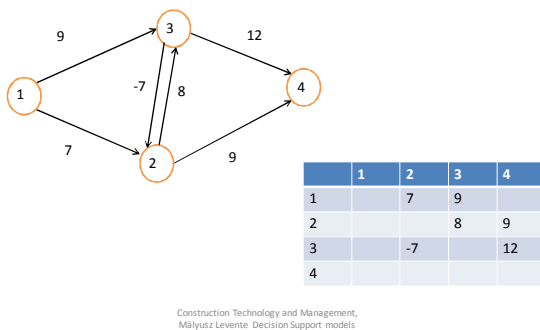
Backward from 2. node



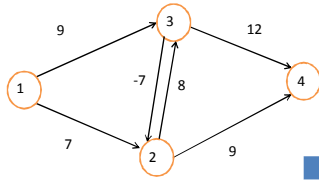
Result: scheduling



Longest path 1-4 and lag times



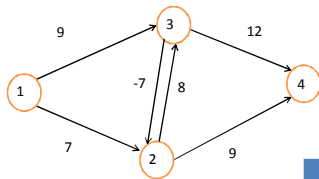
From 1. node



	1	2	3	4
0	1	7	9	
7	2		8	9
9	3	-7		12
	4			

Construction Technology and Management,
Mályusz Levente: Decision Support models

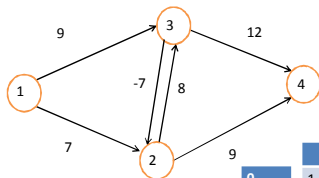
From 2. node



	1	2	3	4
0	1	7	9	
7	2		8	9
9 15	3	-7		12
16	4			

Construction Technology and Management,
Mályusz Levente: Decision Support models

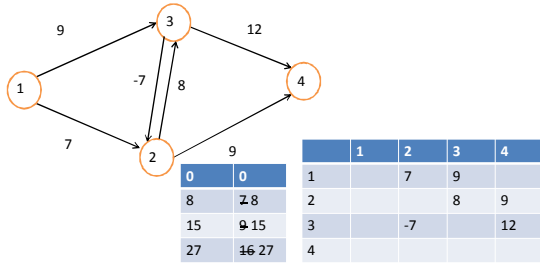
From 3. node



	1	2	3	4
0	1	7	9	
7 8	2		8	9
9 15	3	-7		12
16 27	4			

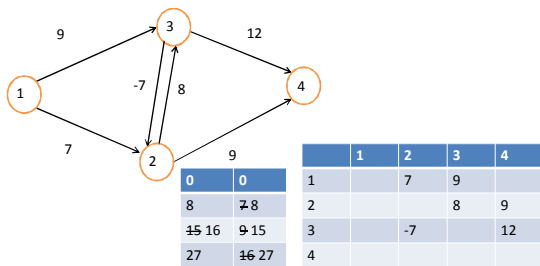
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New iteration from 1. node



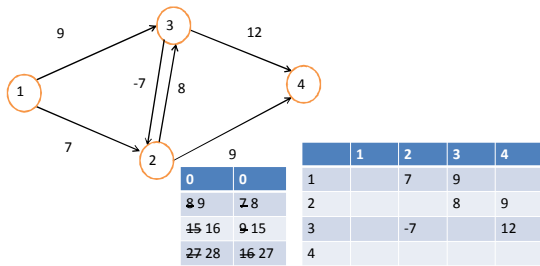
Construction Technology and Management,
Mályusz Levente: Decision Support models

New iteration from 2. node



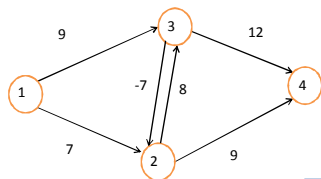
Construction Technology and Management,
Mályusz Levente: Decision Support models

New iteration from 3. node



Construction Technology and Management,
Mályusz Levente: Decision Support models

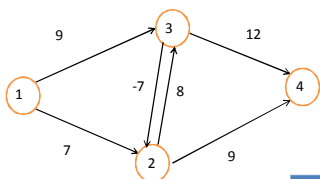
3. Iteration from 1. node



	0	1	2	3	4
0	0	0	0		
9	9	9	7	8	
16	15	16	9	15	
28	27	28	16	27	

Construction Technology and Management,
Mályusz Levente: Decision Support models

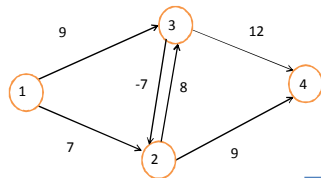
3. Iteration from 2. node



	0	1	2	3	4
0	0	0	0		
9	9	9	7	8	
16	17	15	16	9	15
28	27	28	16	27	

Construction Technology and Management,
Mályusz Levente: Decision Support models

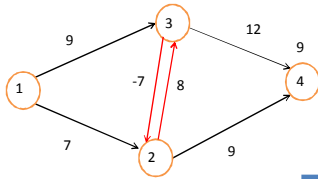
3. Iteration from 3. node



	0	1	2	3	4
0	0	0	0		
9	10	9	7	8	
16	17	15	16	9	15
28	29	27	28	16	27

Construction Technology and Management,
Mályusz Levente: Decision Support models

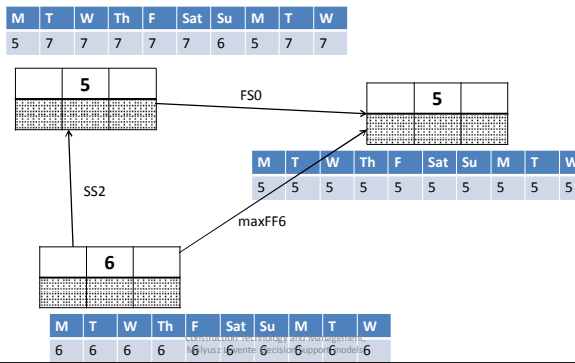
Result: cycle, there is no solution



	1	2	3	4
0	0	0		
9	10	9	8	
16	17	15	16	15
28	29	27	28	16

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Mályusz Levente: Decision Support models

Scheduling with calendar

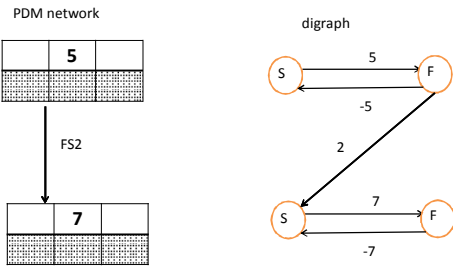


MPM network and the relationship with digraph



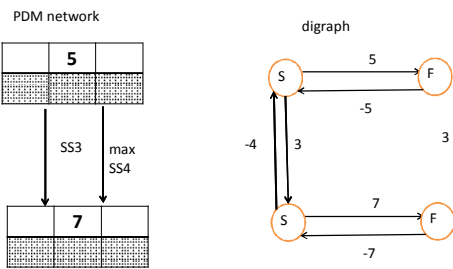
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Relationship between MPM and a digraph



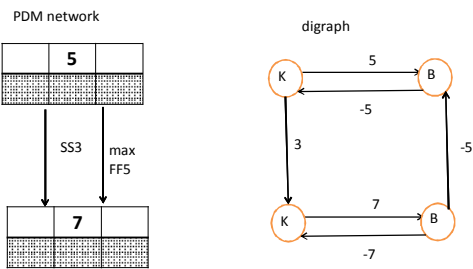
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Relationships of MPM and digraph



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Relationships of MPM and a digraph



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