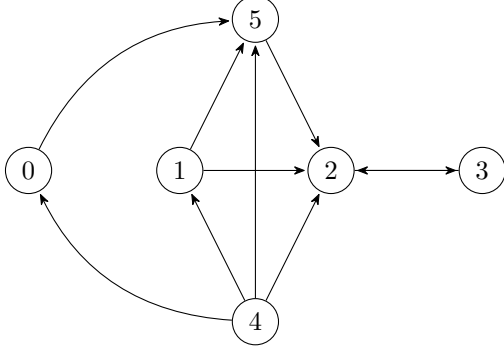

Graph algorithms - practical work no. 2

CRETU CRISTIAN - 913

1 Manual Execution

1.1 First Graph

Lowest length path between s and t using *backward* breadth-first search from t .



$s = 0, t = 3$	X	Y	Queue	Visited	dist-dict	next-dict																								
Initialization			<div>3</div>	{3}	<table><tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td></td><td></td><td></td><td>0</td><td></td><td></td></tr></table>	0	1	2	3	4	5				0			<table><tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	0	1	2	3	4	5						
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Table 1: Backward BFS algorithm from $t = 3$ to $s = 0$

$t = s = 0 \Rightarrow \text{STOP}$

N_{in} dictionary

Key	Value
0	{4}
1	{4}
2	{1,3,4,5}
3	{2}
4	{}
5	{0,1,4}

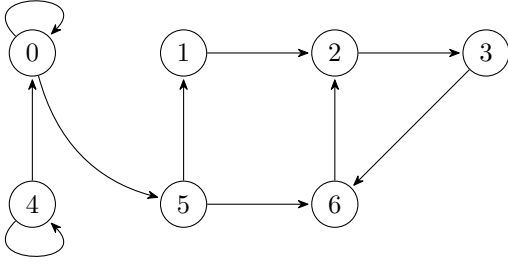
The path is built from next

0	1	2	3	4	5
5	2	3		2	2

, beginning with $s = 0$

$s = 0 \Rightarrow next[0] = 5 \Rightarrow next[5] = 2 \Rightarrow next[2] = 3 = t$
path = [0, 5, 2, 3], length = $dist[s] = dist[0] = 5$

1.2 Second Graph



$s = 4, t = 3$	X	Y	Queue	Visited	dist-dict	next-dict																												
Initialization			3	{3}	<table border="1"> <tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr> <tr><td></td><td></td><td></td><td>0</td><td></td><td></td><td></td></tr> </table>	0	1	2	3	4	5	6				0				<table border="1"> <tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>	0	1	2	3	4	5	6							
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			0																															
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Iteration 1	3																																	
Iteration 1.1		2	← 2 ←	{2, 3}	<table border="1"> <tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr> <tr><td></td><td></td><td>1</td><td>0</td><td></td><td></td><td></td></tr> </table>	0	1	2	3	4	5	6			1	0				<table border="1"> <tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr> <tr><td></td><td></td><td>3</td><td></td><td></td><td></td><td></td></tr> </table>	0	1	2	3	4	5	6			3				
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Iteration 2.1		1	← 1 ←	{1, 2, 3}	<table border="1"> <tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr> <tr><td></td><td>2</td><td>1</td><td>0</td><td></td><td></td><td></td></tr> </table>	0	1	2	3	4	5	6		2	1	0				<table border="1"> <tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr> <tr><td></td><td>2</td><td>3</td><td></td><td></td><td></td><td></td></tr> </table>	0	1	2	3	4	5	6		2	3				
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	2	3																																
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Iteration 5	5		← ←																															
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Iteration 6	0		← ←																															
Iteration 6.1		4	← 4 ←	{0, 1, 2, 3, 4, 5, 6}	<table border="1"> <tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr> <tr><td>4</td><td>2</td><td>1</td><td>0</td><td>5</td><td>3</td><td></td></tr> </table>	0	1	2	3	4	5	6	4	2	1	0	5	3		<table border="1"> <tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr> <tr><td>5</td><td>2</td><td>3</td><td></td><td>0</td><td>1</td><td></td></tr> </table>	0	1	2	3	4	5	6	5	2	3		0	1	
0	1	2	3	4	5	6																												
4	2	1	0	5	3																													
0	1	2	3	4	5	6																												
5	2	3		0	1																													

Table 2: Backward BFS algorithm from $t = 3$ to $s = 0$

$t = s = 4 \Rightarrow \text{STOP}$

N_{in} dictionary

Key	Value
0	{0, 4}
1	{5}
2	{1, 6}
3	{2}
4	{4}
5	{0}
6	{3, 5}

The path is built from next

0	1	2	3	4	5	6
5	2	3		0	1	

, beginning with $s = 4$

$s = 4 \Rightarrow \text{next}[4] = 0 \Rightarrow \text{next}[0] = 5 \Rightarrow \text{next}[5] = 1 \Rightarrow \text{next}[1] = 2 \Rightarrow \text{next}[2] = 3 = t$
 path = [4, 0, 5, 1, 2, 3], length = $\text{dist}[s] = \text{dist}[4] = 5$

2 Results from my algorithm

2.1 graph1k.txt

1- 100 - [1, 5, 487, 175, 699, 624, 100] - **Length: 6**

100 - 1 - [100, 416, 354, 865, 109, 1] - **Length: 5**

2.2 graph10k.txt

1- 100 - [1, 7317, 4118, 2404, 690, 1494, 739, 4722, 100] - **Length: 8**

100 - 1 - [100, 5568, 2781, 1451, 4997, 528, 4260, 1] - **Length: 7**

2.3 graph100k.txt

1- 100 - [1, 17024, 27471, 14969, 3075, 4156, 32753, 14973, 100] - **Length: 8**

100 - 1 - [100, 44340, 54527, 6606, 53263, 95930, 98655, 58288, 1] - **Length: 8**

2.4 graph1m.txt

1- 100 - [1, 780841, 823682, 497694, 783457, 129409, 417148, 504039, 402806, 368447, 377207, 100] - **Length:**

11

100 - 1 - [100, 626497, 269491, 234916, 654665, 59455, 354621, 375347, 462639, 208831, 1] - **Length: 10**