COM2031 Advanced Algorithms, Autumn Semester 2019

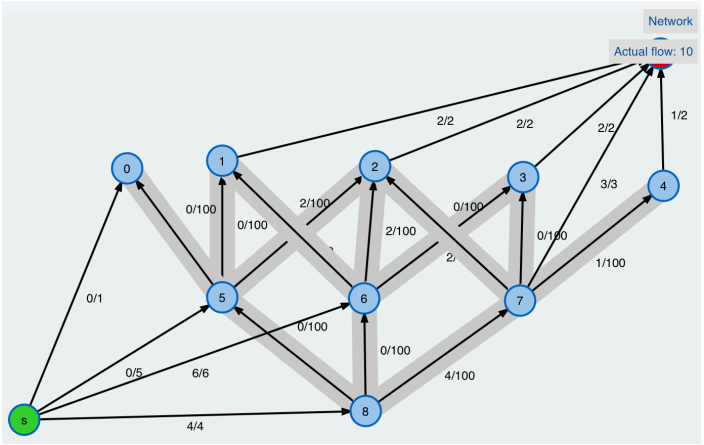
Lab 10: Open Pit Mining: More Applications of Network Flow Solutions

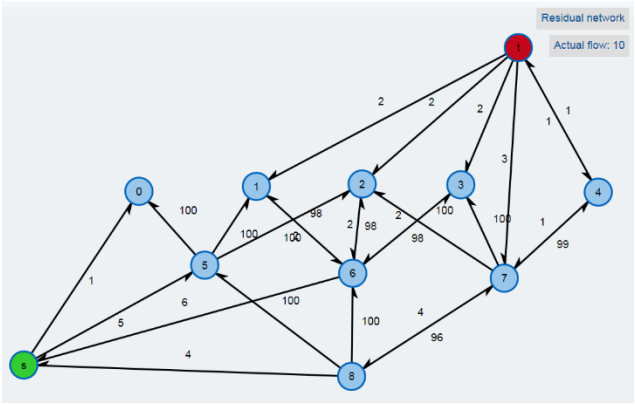
Question 1: What are the optimal blocks to mine in the following example?

1	– 2	– 2	– 2	– 2
	5	6	– 3	
		4		

Solution:

1	-2	-2	-2	-2
	5	6	-3	
		4		





The minimum cut is identified as:

S to 8

1 to t

2 to t

3 to t

Bricks to excavate are (1, 5, 2, 3, 6, 0) for net value: 6

This means 8 is not taken (worth 4), but require dependency of -3 and -2, which is

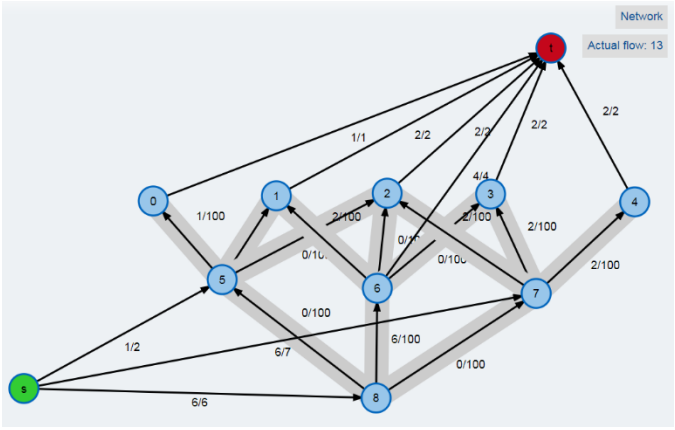
-5 cost, which makes sense that we avoided a loss of -1.

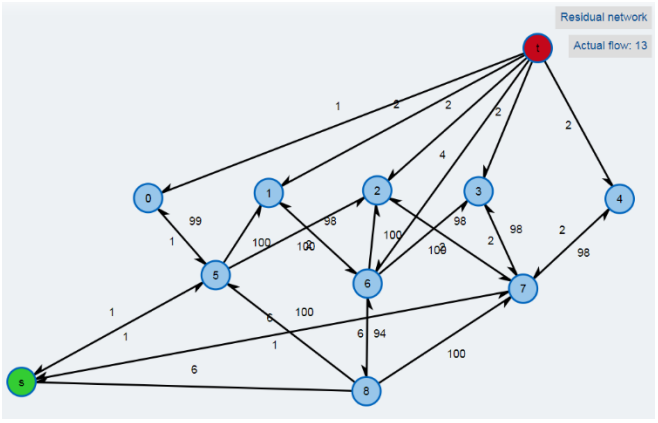
Question 2: What are the best blocks to mine in the following example?

−1	−2	−2	−2	−2
	2	−4	7	
		6		

Solution:

-1	-2	-2	-2	-2
	2	-4	7	
		6		





The minimum cut is identified as:

0 to t

1 to t

2 to t

3 to t

4 to t

6 to t

Bricks to excavate are (0, 5, 1, 2, 7, 3, 4, 8, 6) for net value: 2

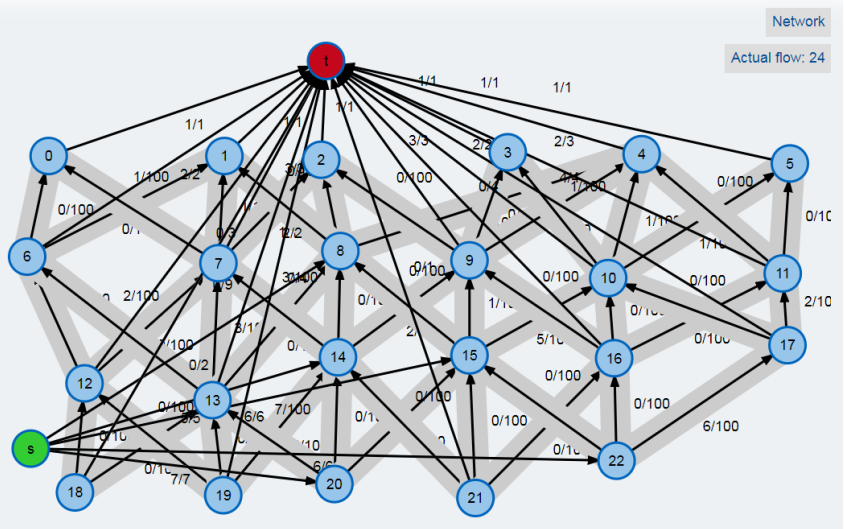
This means all of them are taken because obviously the highest values are 7 and 6 and at the bottom, so it makes sense.

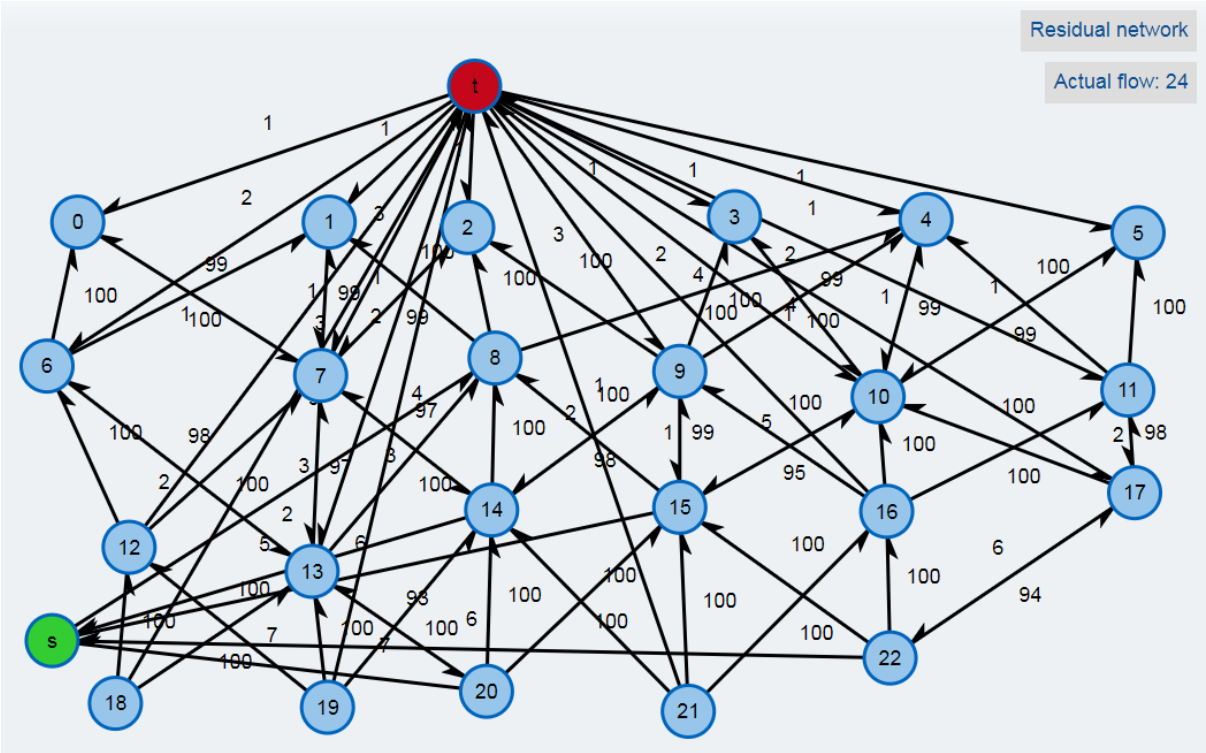
Question 3: What is the optimal mine in the following example?

-1	-1	-1	-1	-1	-1
-2	-3	2	-3	-2	-3
-3	-2	5	6	-4	-4
-9	-4	7	-1	6	

Solution:

-1	-1	-1	-1	-1	-1
-2	-3	2	-3	-2	-3
-3	-2	5	6	-4	-4
-9	-4	7	-1	6	





The minimum cut is identified as:

```
1 - 22
2 - t
3 - t
4 - t
5 - t
6 – t
7 - t
8 - t
9 - t
11 - t
12 - t
15 – t
```

Bricks to excavate are (0, 6, 1, 8, 2, 3, 4, 9, 5, 10, 13, 7, 14, 15, 20) for net value: 2

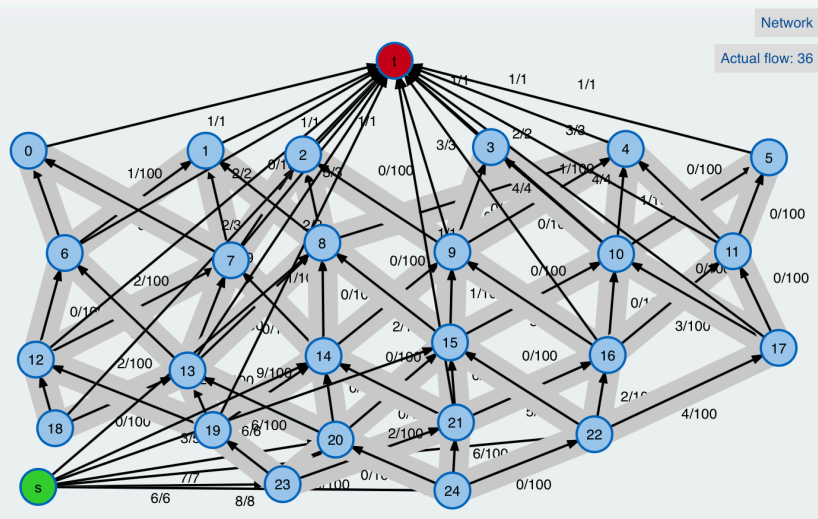
This also makes sense, because all positive blocks that are omitted will require dependency of higher cost of negative values.

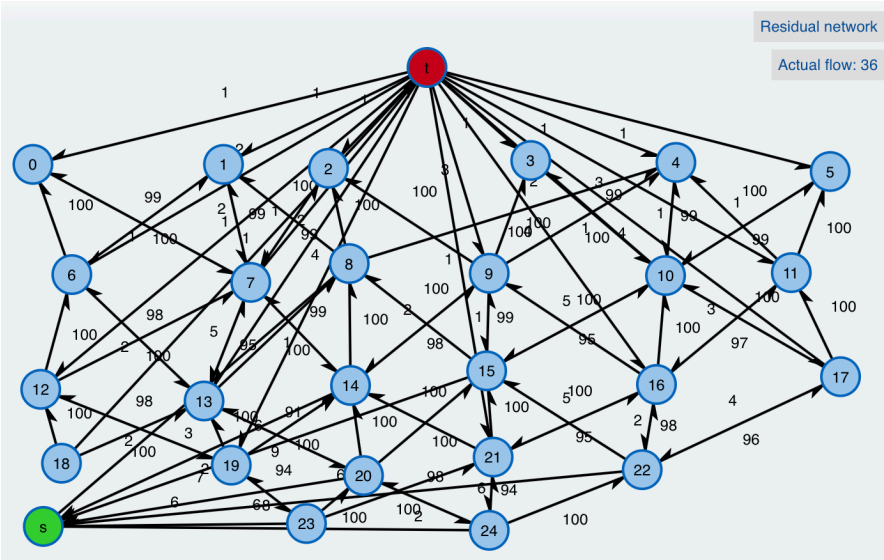
Question 4: What is the optimal mine in the following example – the same as the previous question except with two additional blocks in the fifth layer down?

-1	-1	-1	-1	-1	-1
-2	-3	2	-3	-2	-3
-3	-2	5	6	-4	-4
-9	-4	7	-1	6	
		6	8		

Solution:

-1	-1	-1	-1	-1	-1
-2	-3	2	-3	-2	-3
-3	-2	5	6	-4	-4
-9	-4	7	-1	6	
		6	8		





The min-cut is defined to be:

```
s – 23
0 – t
1 – t
2 – t
3 – t
4 – t
5 – t
6 – t
7 – t
9 – t
10 – t
11 – t
13 – t
16 – t
17 – t
21 – t
```

Selected Projects/Blocks are: (0, 6, 1, 8, 2, 3, 4, 9, 5, 10, 13, 7, 14, 15, 11, 16, 20, 21, 22, 17, 24) for net value: 4

This also makes sense, because all positive blocks that are omitted will require dependency of higher cost of negative values.