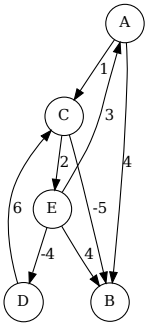
CS5200 Homework 4 Graphs
Adam McNeil
Question 1



$D(0) =$

	A	B	C	D	E
A	0	4	1	∞	∞
B	∞	0	∞	∞	∞
C	∞	-5	0	∞	2
D	∞	∞	6	0	∞
E	3	4	∞	-4	0

$\pi(0) =$

	A	B	C	D	E
A	nil	A	A	nil	nil
B	nil	nil	nil	nil	nil
C	nil	C	nil	nil	C
D	nil	nil	D	nil	nil
E	E	E	nil	E	nil

$D(1) =$

	A	B	C	D	E
A	0	4	1	∞	∞
B	∞	0	∞	∞	∞
C	∞	-5	0	∞	2
D	∞	∞	6	0	∞
E	3	4	4	-4	0

$\pi(1) =$

	A	B	C	D	E
A	nil	A	A	nil	nil
B	nil	nil	nil	nil	nil
C	nil	C	nil	nil	C
D	nil	nil	D	nil	nil
E	E	E	A	E	nil

$D(2) =$

	A	B	C	D	E
A	0	4	1	∞	∞
B	∞	0	∞	∞	∞
C	∞	-5	0	∞	2
D	∞	∞	6	0	∞
E	3	4	4	-4	0

$\pi(2) =$

	A	B	C	D	E
A	nil	A	A	nil	nil
B	nil	nil	nil	nil	nil
C	nil	C	nil	nil	C
D	nil	nil	D	nil	nil
E	E	E	A	E	nil

$D(3) =$

	A	B	C	D	E
A	0	-4	1	∞	3
B	∞	0	∞	∞	∞
C	∞	-5	0	∞	2
D	∞	1	6	0	8
E	3	-1	4	-4	0

$\pi(3) =$

	A	B	C	D	E
A	nil	C	A	nil	C
B	nil	nil	nil	nil	nil
C	nil	C	nil	nil	C
D	nil	C	D	nil	C
E	E	C	A	E	nil

$D(4) =$

	A	B	C	D	E
A	0	-4	1	∞	3
B	∞	0	∞	∞	∞
C	∞	-5	0	∞	2
D	∞	1	6	0	8
E	3	-3	2	-4	0

$\pi(4) =$

	A	B	C	D	E
A	nil	C	A	nil	C
B	nil	nil	nil	nil	nil
C	nil	C	nil	nil	C
D	nil	C	D	nil	C
E	E	D	D	E	nil

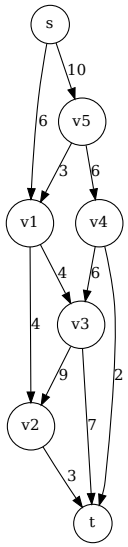
$D(5) =$

	A	B	C	D	E
A	0	-4	1	-1	3
B	∞	0	∞	∞	∞
C	5	-5	0	-2	2
D	11	1	6	0	8
E	3	-3	2	-4	0

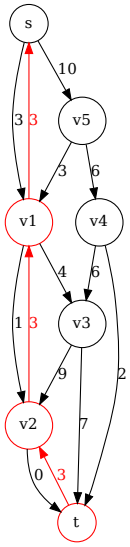
$\pi(5) =$

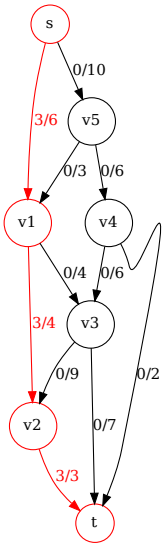
	A	B	C	D	E
A	nil	C	A	E	C
B	nil	nil	nil	nil	nil
C	E	C	nil	E	C
D	E	C	D	nil	C
E	E	D	D	E	nil

Question 2

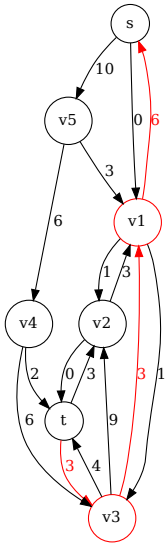


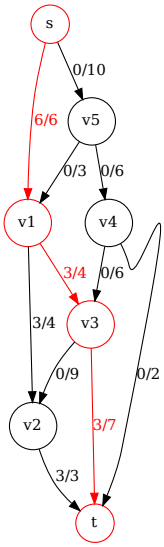
Step 1


s
10
3
3
v5
3
6
v1
v4
4
6
1
3
v3
9
2
v2
7
0
3
t

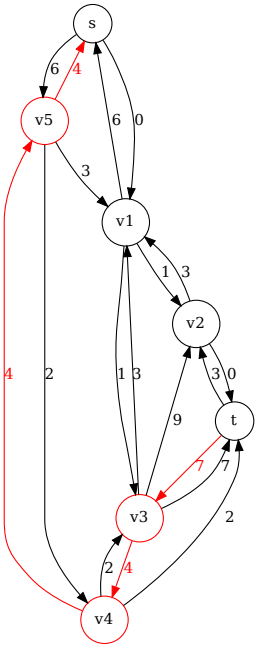

s
0/10
3/6
v5
0/3
0/6
v1
v4
0/4
0/6
3/4
v3
0/9
0/2
v2
0/7
3/3
t

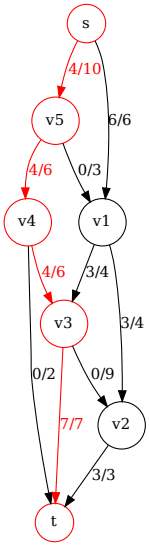
Step 2


s
10
v5
0
6
3
v1
6
1
3
v4
v2
2
0
3
3
1
6
t
9
3
4
v3

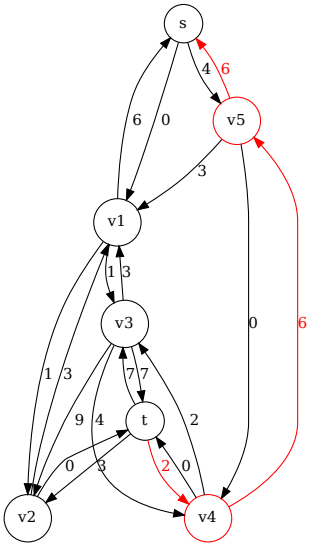

s
0/10
6/6
v5
0/3
0/6
v1
v4
3/4
0/6
3/4
v3
0/9
0/2
v2
3/7
3/3
t

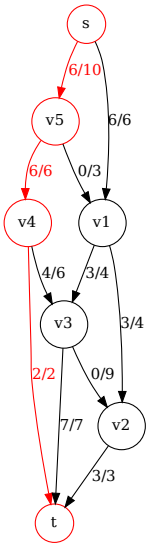
Step 3


s
v5
v1
v2
t
v3
v4
6
4
6
0
3
1
3
4
2
1
3
3
0
9
7
7
2
2
4


s
v5
v4
v1
v3
v2
t
4/10
6/6
4/6
0/3
4/6
3/4
3/4
0/2
0/9
7/7
3/3

Step 4





Question 3

Strategy A: 5 different paths are needed until the final answer is reached

$s->v1->v2->t$

$s->v6->v3->t$

$s->v5->v4->t$

$s->v1->v3->t$
$s->v5->v4->v3->t$

Strategy B: 4 different paths are need until the final answer is reached
$s->v5->v4->v3->t$
$s->v1->v2->t$
$s->v5->v6->v3->v4->t$
$s->v6->v3->t$
Strategy A is always worse or equal to Strategy B.

Question 4
1) For a given cut (S, T), the net flow from S to T can be greater than capacity of S and T.
False
2) For any (S, T) cut, if the net flow equals to the capacity of S and T, then we cannot find any augmenting path in the residual graph.
True
3) The Floyd-Warshall algorithm belongs to the greedy algorithm, as it is more efficient than the dynamic programming solution.
False
4) The Dijksta's algorithm can be used to find the all-pairs shortest paths in a weighted directed graph, and it is more efficient than some dynamic programming solution.
True

Bonus: