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Problem 1

1.

D2

0	1	7	4	11	9
5	0	12	3	23	4
2	3	0	∞	3	2
3	-2	22	0	2	1
4	2	2	4	0	4
8	3	3	5	1	0

D8

0	1	7	4	6	5
5	0	7	3	5	4
2	3	0	6	3	2
3	-2	4	0	2	1
4	2	2	4	0	4
5	3	3	5	1	0

D4

0	1	7	4	6	5
5	0	7	3	5	4
2	3	0	6	3	2
3	-2	5	0	2	1
4	2	2	4	0	4
5	3	3	5	1	0

2.

D1

0	1	7	∞	∞	10
5	0	12	3	∞	15
2	3	0	∞	∞	2
∞	-2	∞	0	20	1
∞	∞	2	4	0	∞
∞	3	∞	∞	1	0

D2

0	1	7	4	∞	10
5	0	12	3	∞	15
2	3	0	6	∞	2
3	-2	10	1	20	1
∞	∞	2	4	0	∞
8	3	15	6	1	0

D3

0	1	7	4	∞	9
5	0	12	3	∞	14
2	3	0	6	∞	2
3	-2	10	1	20	1
4	5	2	4	0	4
8	3	15	6	1	0

D4

0	1	7	4	24	5
5	0	12	3	23	4
2	3	0	6	26	2
3	-2	10	1	20	1
4	5	2	4	0	4
8	3	15	6	1	0

D5

0	1	7	4	24	5
5	0	12	3	23	4
2	3	0	6	26	2
3	-2	10	1	20	1
4	5	2	4	0	4
5	3	3	5	1	0

D6

0	1	7	4	6	5
5	0	7	3	5	4
2	3	0	6	8	2
3	-2	4	1	2	1
4	5	2	4	0	4
5	3	3	5	1	0

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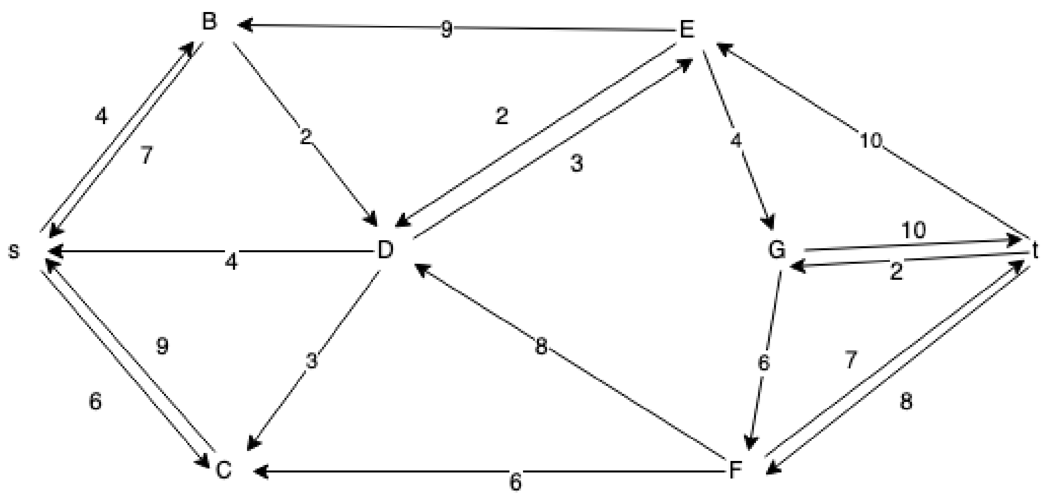
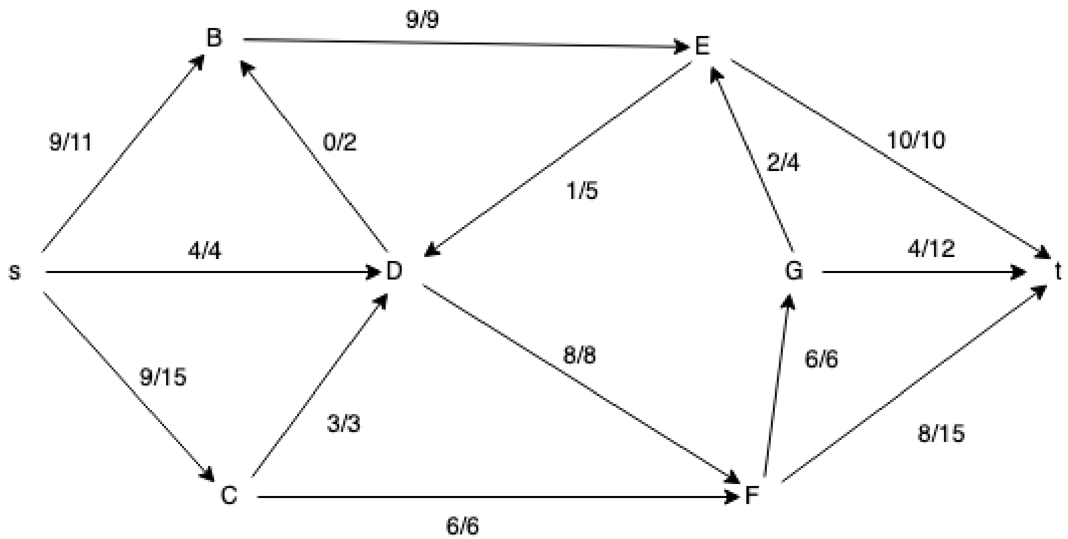
Problem 2

a)



b) p = {s, B, D, E, G, t}
$c_f(p) = 2$

c)



d) min cut = { {s, B, C} , {D, E, F, G, t} } = 22
By max-flow-min-cut theorem, max flow = 22

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Problem 3

a) Let T'_1 and T'_2 be the MST of G that remove edge e = (u, v)
after increasing the weight, there will be two cases:
1. e = (u, v) is still the lightest edge
this mean T' = T

2. there is e' = (u', v') that lighter than e = (u, v)
this mean e' = (u', v') is added to connect T'_1 and T'_2 , and therefore T and T' differ by at most one edge.

b) Assume we know the weight of edge e = (u, v) has been change to new weight.
Go through the MST and separate the nodes into two sets(T_1, T_2) by removing edge e = (u, v) [O(V)]
Go through all the edges and find those that can connect T_1 and T_2 as $E_{connect}$ [O(E)]
Look for the min cost edge in $E_{connect,}$ and connect T_1 and $T_{2\,.}$ [O(1)]