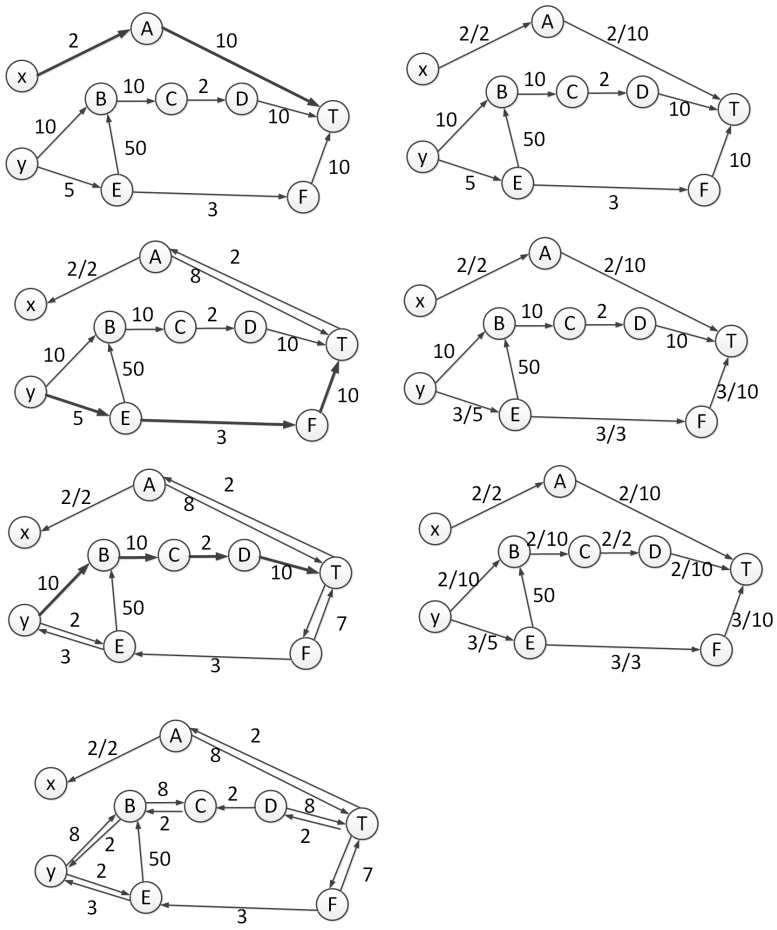
1 Exercise 1

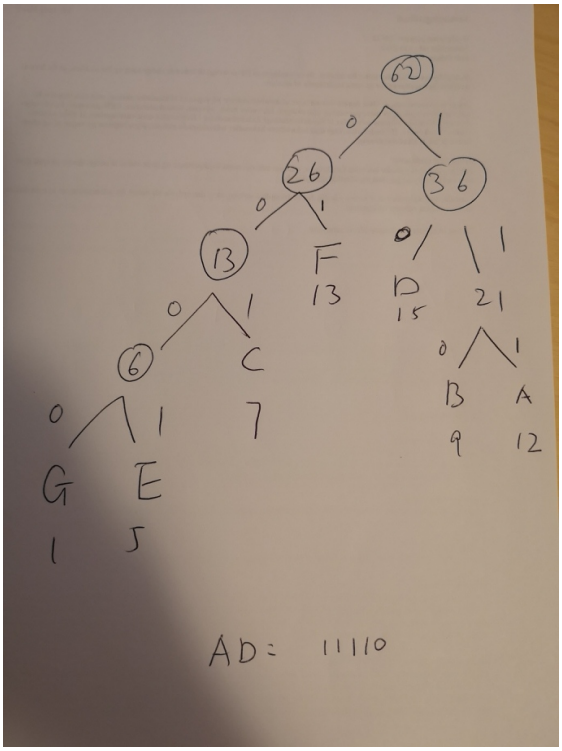
1.



Critical edges: XA, EF, and CD.
Maximum flow: 7.

2. A:111 D:10

3 J
Sweepline status:
A
H, A
H
H, D
J, H, D



4 a

Range tree: $\Theta(\lg^2 n + k)$
kd tree: $\Theta(\sqrt{n} + k)$
2 BSTs: $\Theta(\lg n + k_x + k_y)$
k is zero in this specific case

2 Exercise 2

1

i-th Operation	1	2	3	4	5	6	7	8	9	10
Cost	1	1	**3**	1	1	1	1	1	**9**	1
Cost	1	1	1+(3^1-1)	1	1	1	1	1	1+(3^2-1)	1

Aggregate analysis: When i is a power of 3, we write the cost into $1 + (3^x - 1)$, so that it also has a cost of 1 and the remaining cost $(3^x - 1)$. x is from 1 to $log_3 n$.

Then, since we have n operations, each has at least a cost of 1, so the sum is n. Next, the sum of the remaining cost is $\sum_{x=1}^{\log_3 n}(3^x - 1) = \sum_{x=1}^{\log_3 n} 3^x - \log_3 n = \frac{3}{2}n - \frac{3}{2} - \log_3 n \leq 1.5n$.

So all together the cost is less than $2.5n$. The amortized cost is at most 2.5.

2 Configuration: (X, Y): X contains the vertices that are already in the cycle and Y contains the vertices to be considered.

From the last vertex in X, we check whether there exist an adjacent vertex that is not in X. If we find such a vertex, we add the vertex as part of the solution. If we do not find a vertex and Y is not empty, then it is a deadend. If we do not find a vertex and Y is empty, and there exists an edge connecting the last vertex in X and the first vertex in X, then it is a solution.