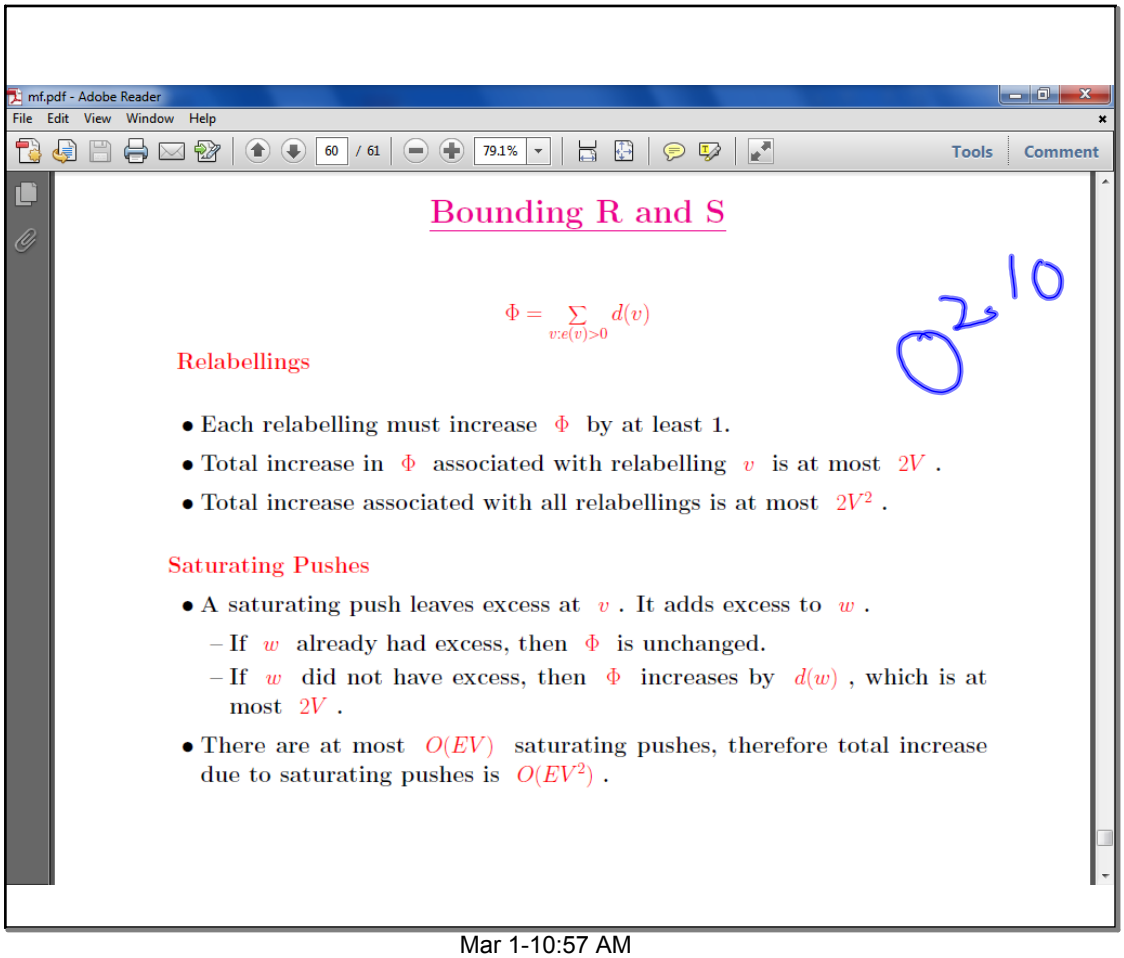

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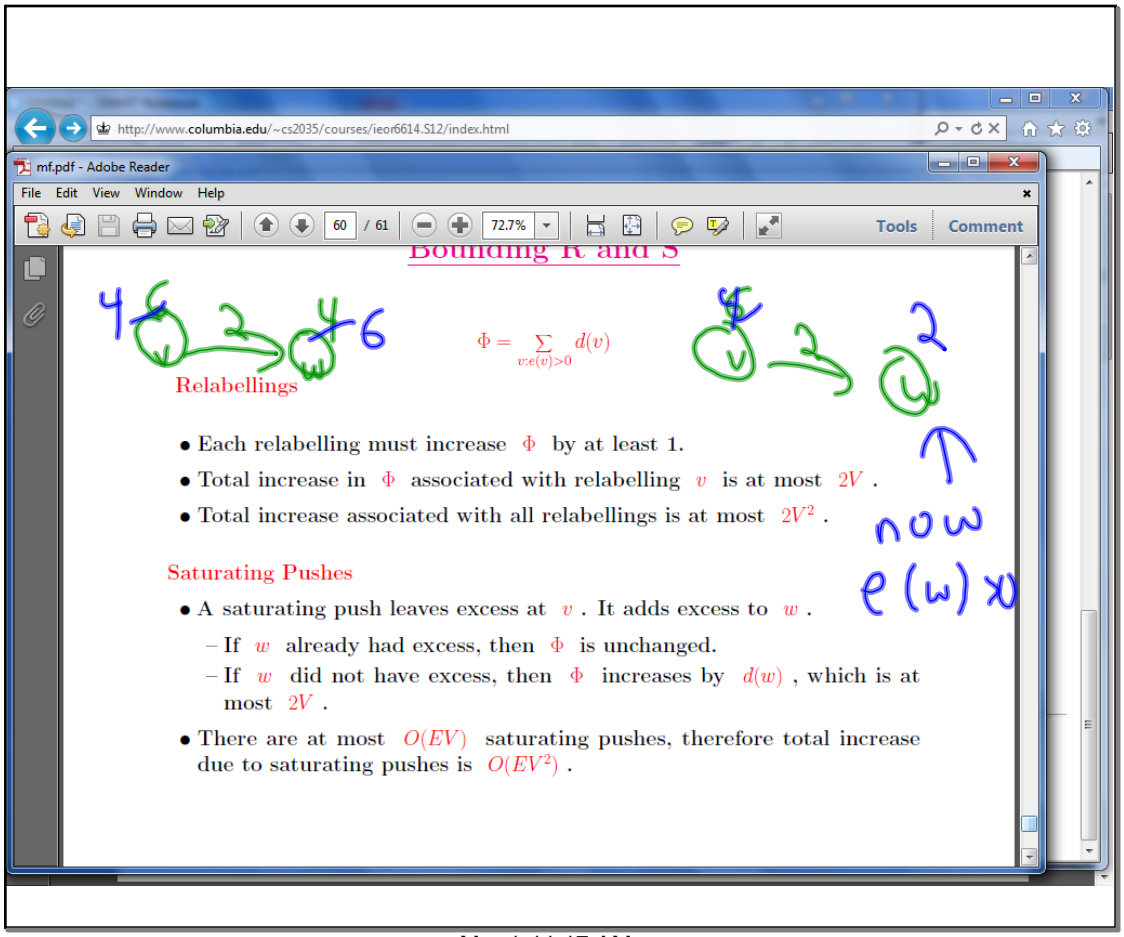

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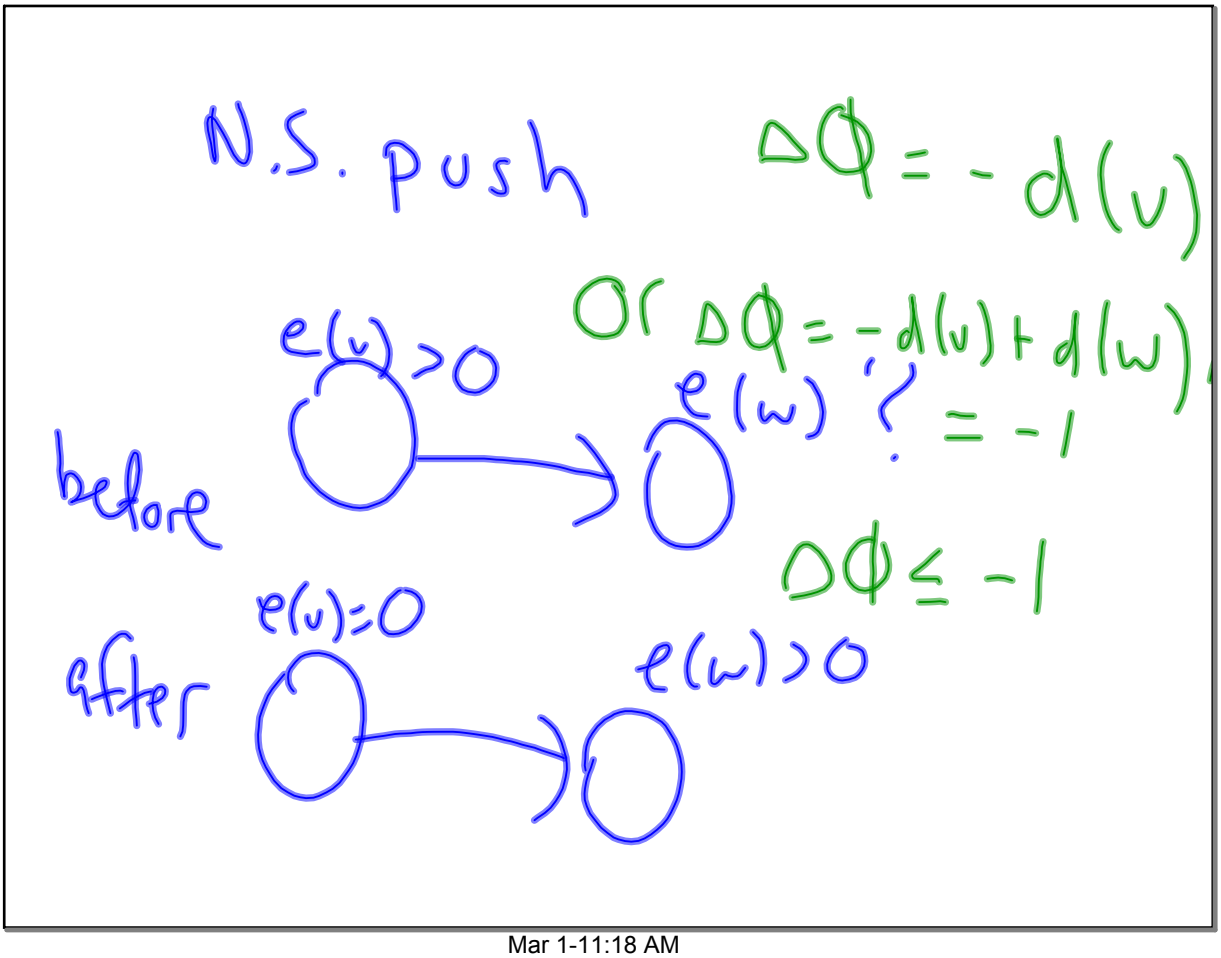

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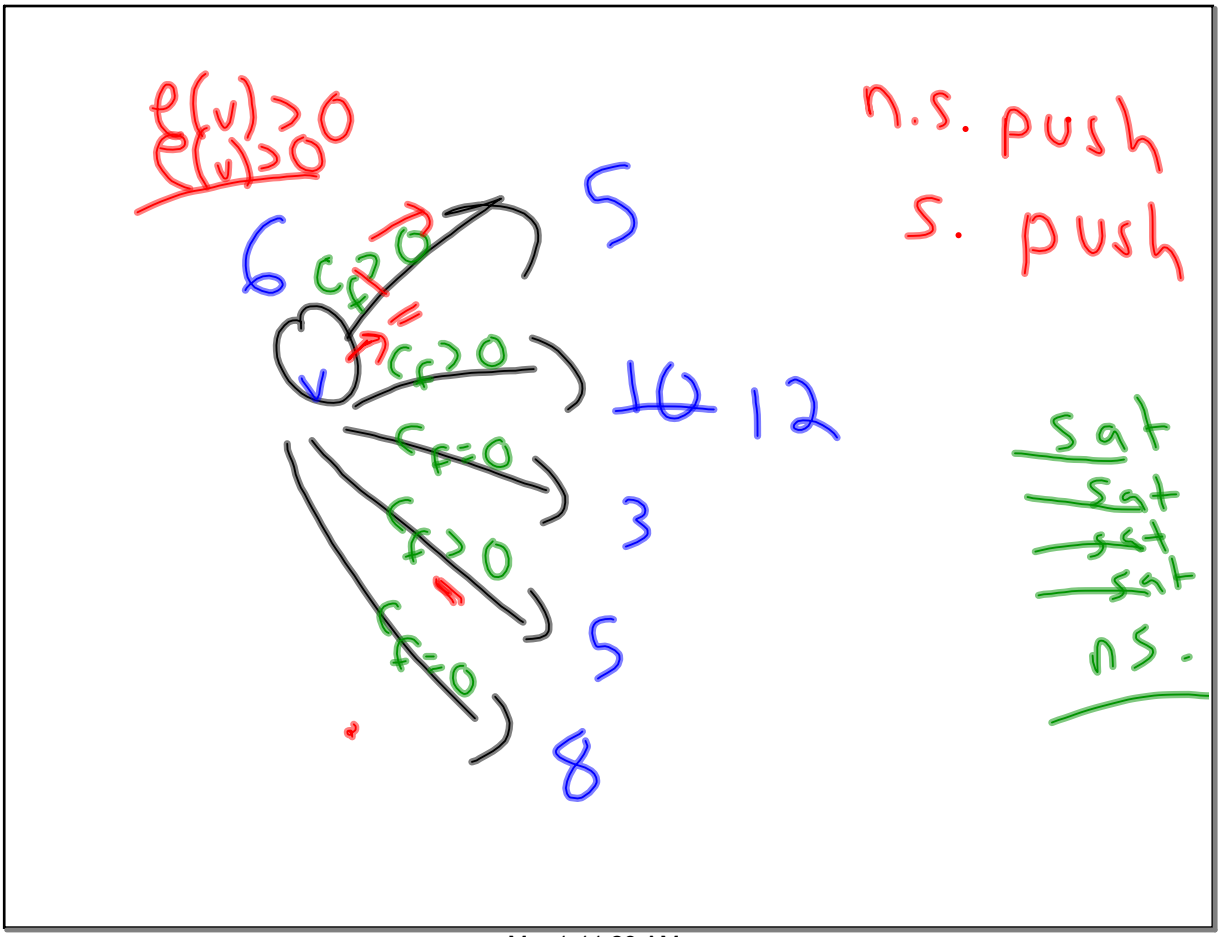

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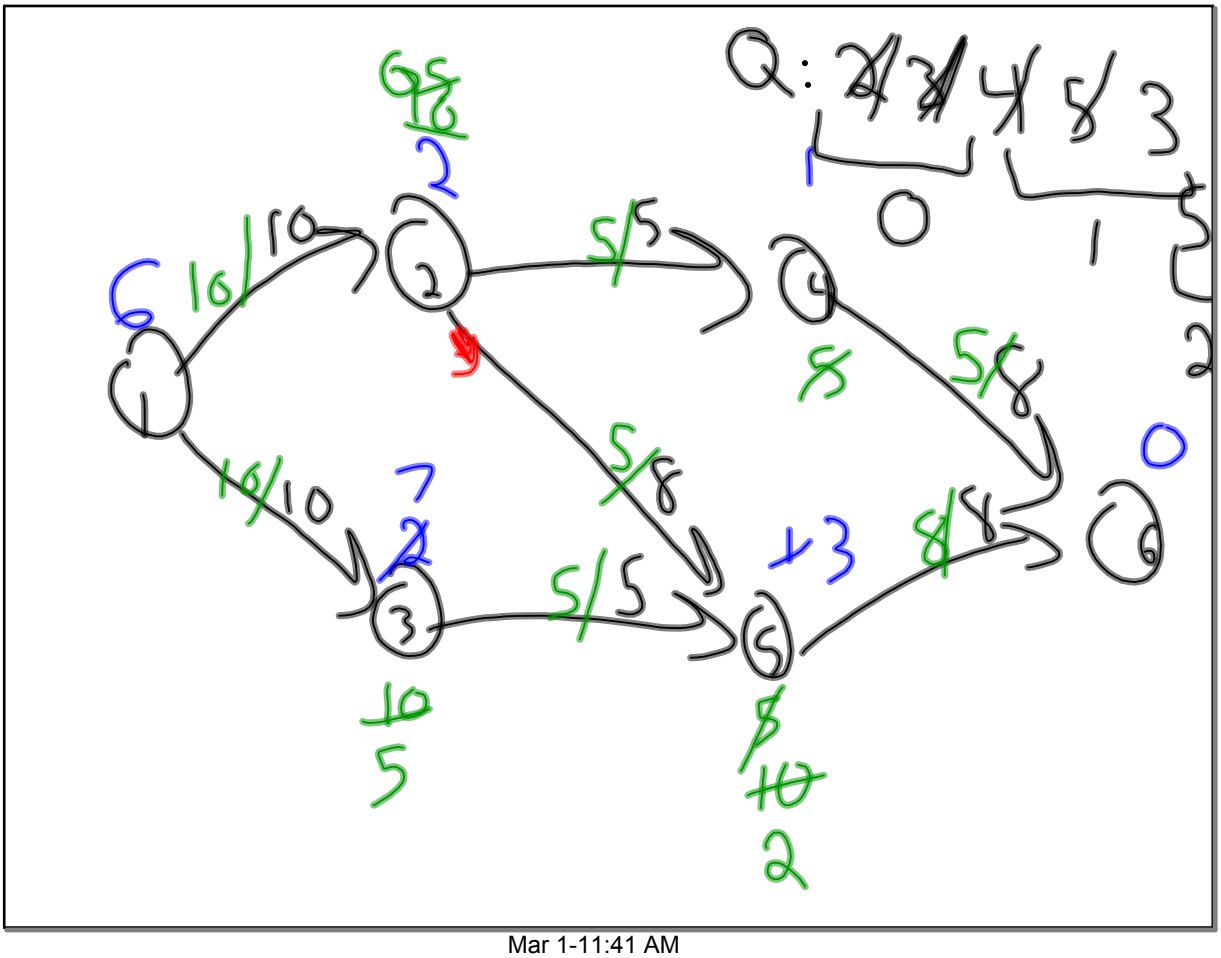

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Look at Q during a phase

Case 1: Some vertex is relabelled during a phase

Case 2. No vertex is relabelled during a phase.

Mar 1-11:53 AM

Case 1: Φ can increase, decrease, or stay same.

$2n$ ↑ 0

Φ At most $O(n^2)$ relabellings, $\therefore$ at most $O(n^2)$ case 1 phases.

Total increase in Φ due to relabellings is at most $O(n^2)$

Mar 1-11:55 AM

Case 2: No relabelling occurs

abcd | xyzc

If v^* had max $d(v)$ then v^* is not in Q at end of phase. All new vertices added to Q have $d(w) < d(v^*)$

$\Rightarrow \Phi$ decreases by at least 1.

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Total increase in Φ over the whole alg is $\leq 2n^2$

$\Phi_{init} \leq n-1$

$\Phi_{final} = 0$

Total decrease $\leq 2n^2 + n - 1$
$= O(n^2)$

Total # of case 2 phases $= O(n^2)$

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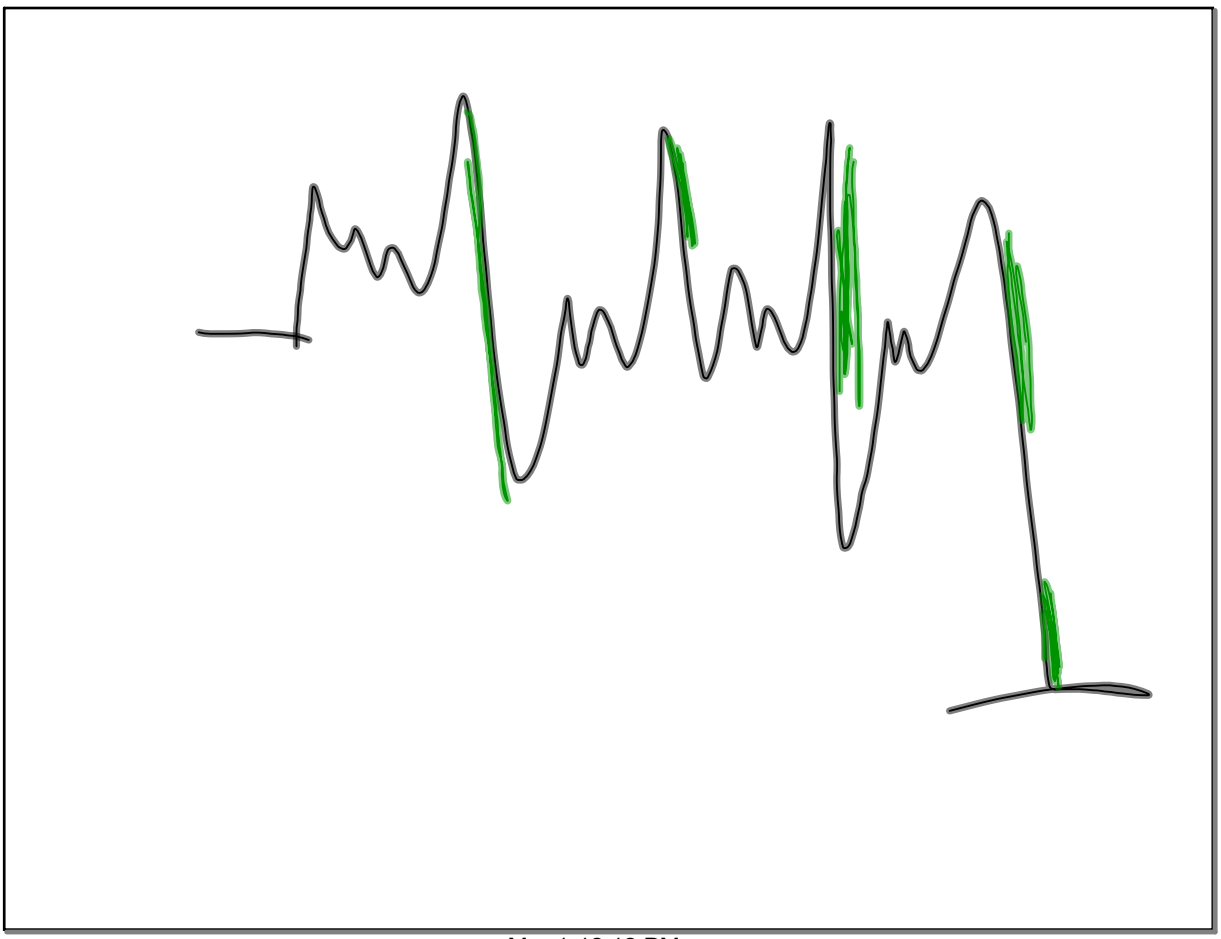

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