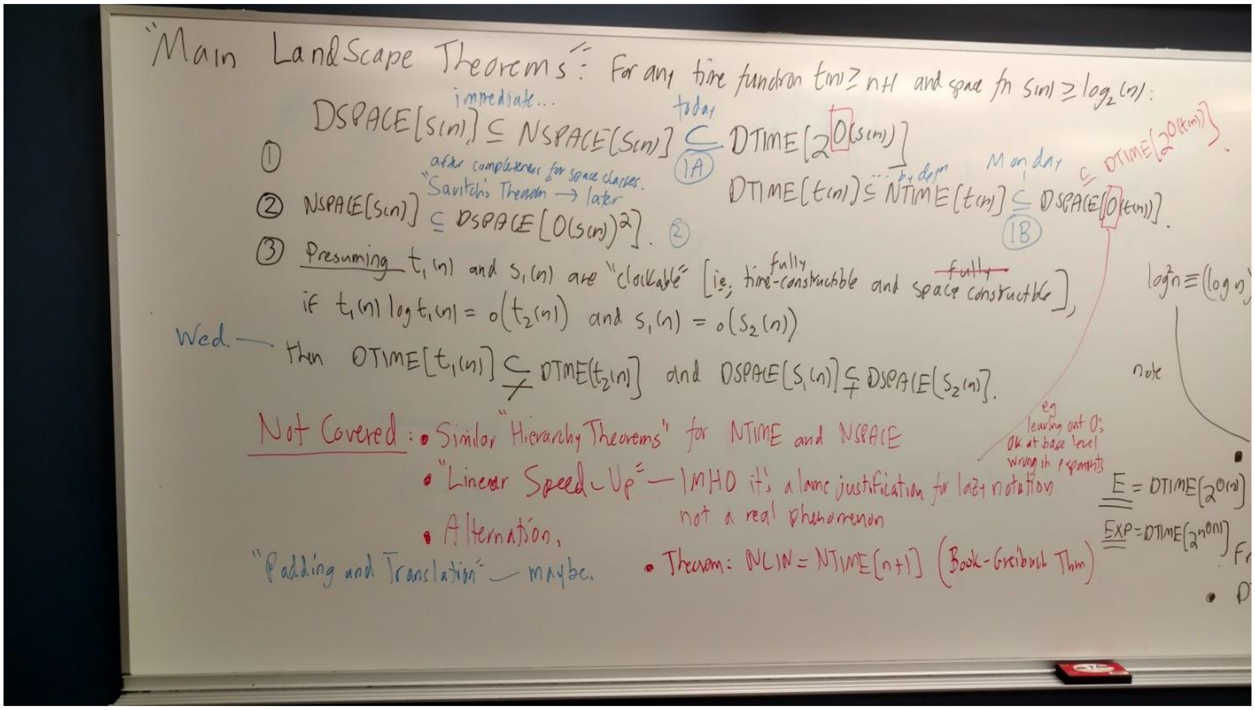
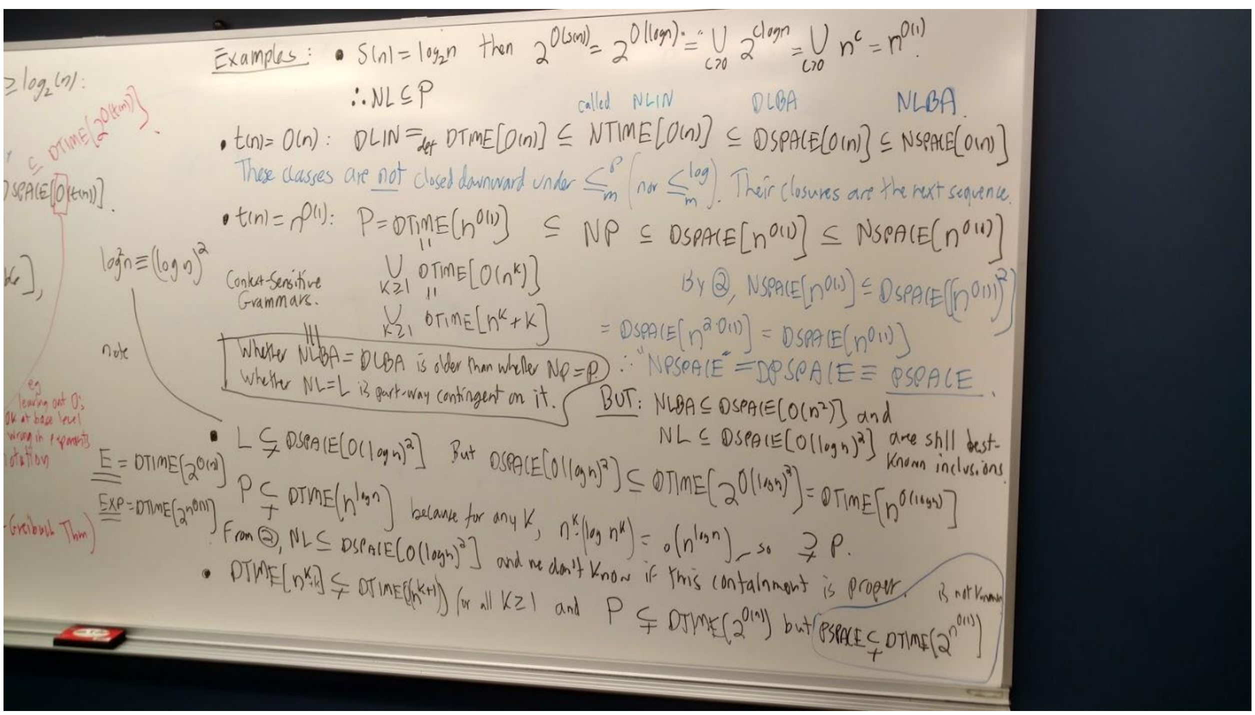
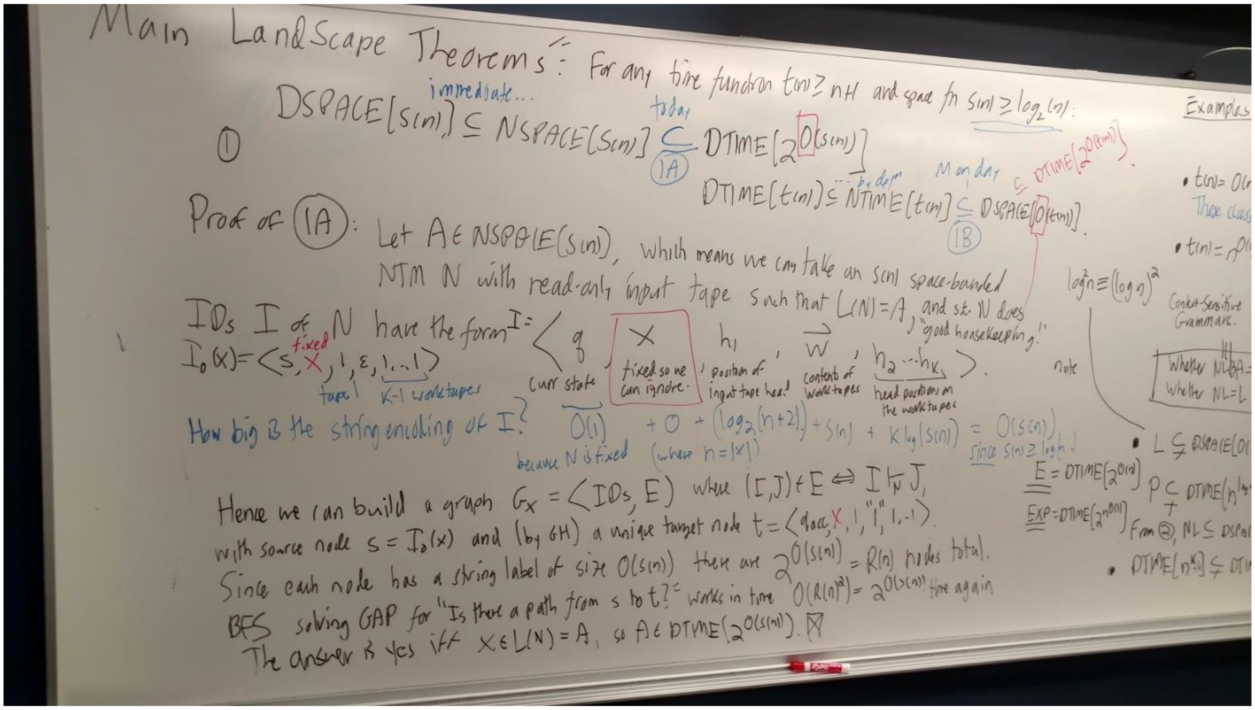
CSE596 Lecture Friday Nov. 1, 2019






Main LandScape Theorems: For any time function t(n) ≥ n+1 and space fn s(n) ≥ log2(n):
immediate...
① DSPACE[s(n)] ⊆ NSPACE[s(n)] ⊆ DTIME[2^O(s(n))]
today
1A
DTIME[t(n)] ⊆ NTIME[t(n)] ⊆ DSPACE[O(t(n))].
by defn
Monday
1B
⊆ DTIME[2^O(t(n))]
Examples
• t(n) = O(
These class
• t(n) = n^O(
log²n ≡ (log n)²
Context-Sensitive Grammars.
Whether NLBA =
Whether NL = L
Proof of 1A: Let A ∈ NSPACE(s(n)), which means we can take an s(n) space-bounded NTM N with read-only input tape such that L(N) = A, and s.t. N does "good housekeeping!"
IDs I of N have the form I = ⟨ q, x, h1, w, h2 ... hk ⟩.
curr state
fixed so we can ignore.
position of input tape head
contents of worktapes
head positions on the worktapes
I0(x) = ⟨s, x, 1, ε, 1, ..1⟩
fixed
tape 1
k-1 worktapes
How big is the string encoding of I? O(1) + 0 + (log2(n+2)) + s(n) + k log(s(n)) = O(s(n))
because N is fixed
(where n = |x|)
since s(n) ≥ log n.
note
• L ⊊ DSPACE[O(
E = DTIME[2^O(n)]
EXP = DTIME[2^n^O(1)]
P ⊊ DTIME[n^log
From ②, NL ⊆ DSPA
• DTIME[n^k] ⊊ DTI
Hence we can build a graph Gx = ⟨IDs, E⟩ where (I, J) ∈ E ⟺ I ⊢N J,
with source node s = I0(x) and (by GH) a unique target node t = ⟨qacc, x, 1, "1", 1, -1⟩.
Since each node has a string label of size O(s(n)) there are 2^O(s(n)) = R(n) nodes total.
BFS solving GAP for "Is there a path from s to t?" works in time O(R(n)²) = 2^O(s(n)) time again
The answer is yes iff x ∈ L(N) = A, so A ∈ DTIME[2^O(s(n))]. ☒