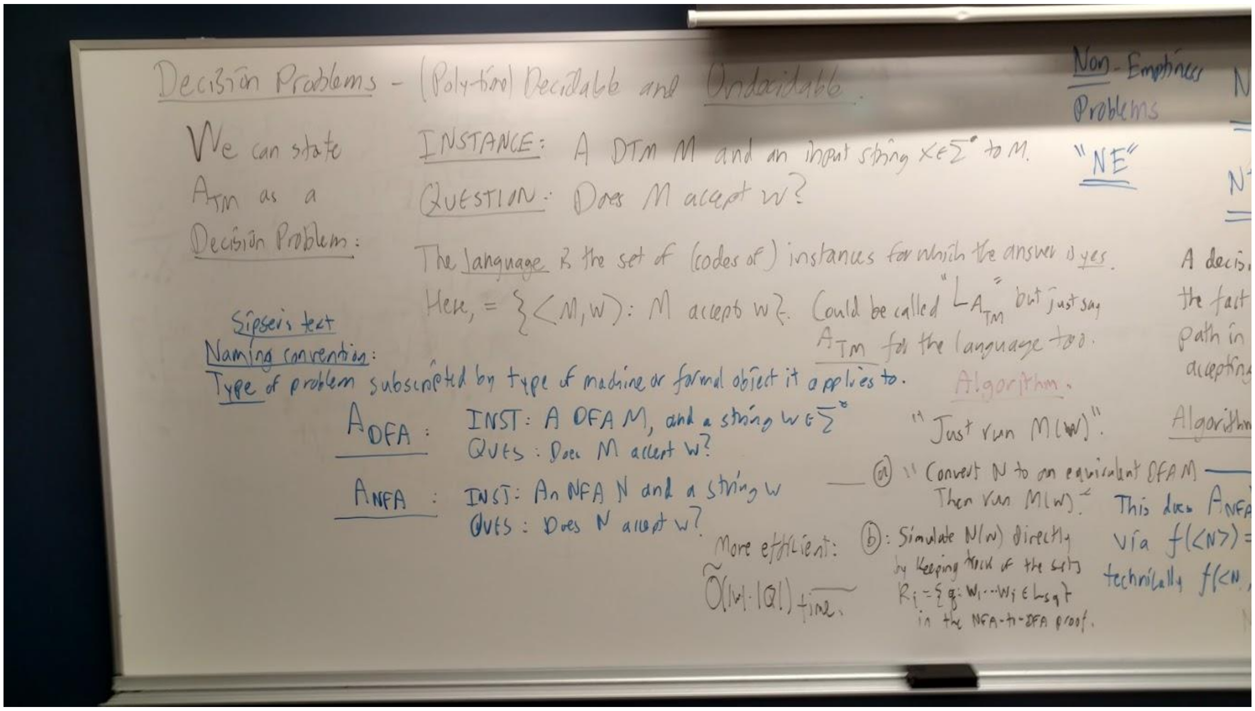
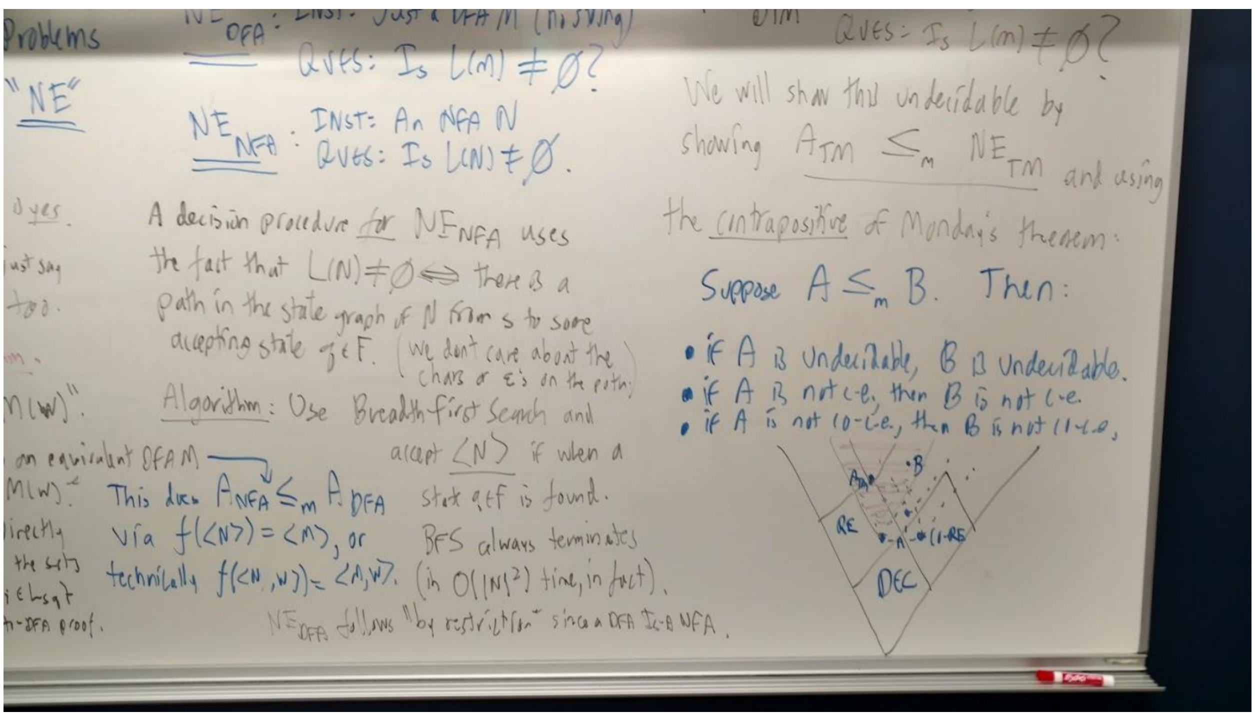
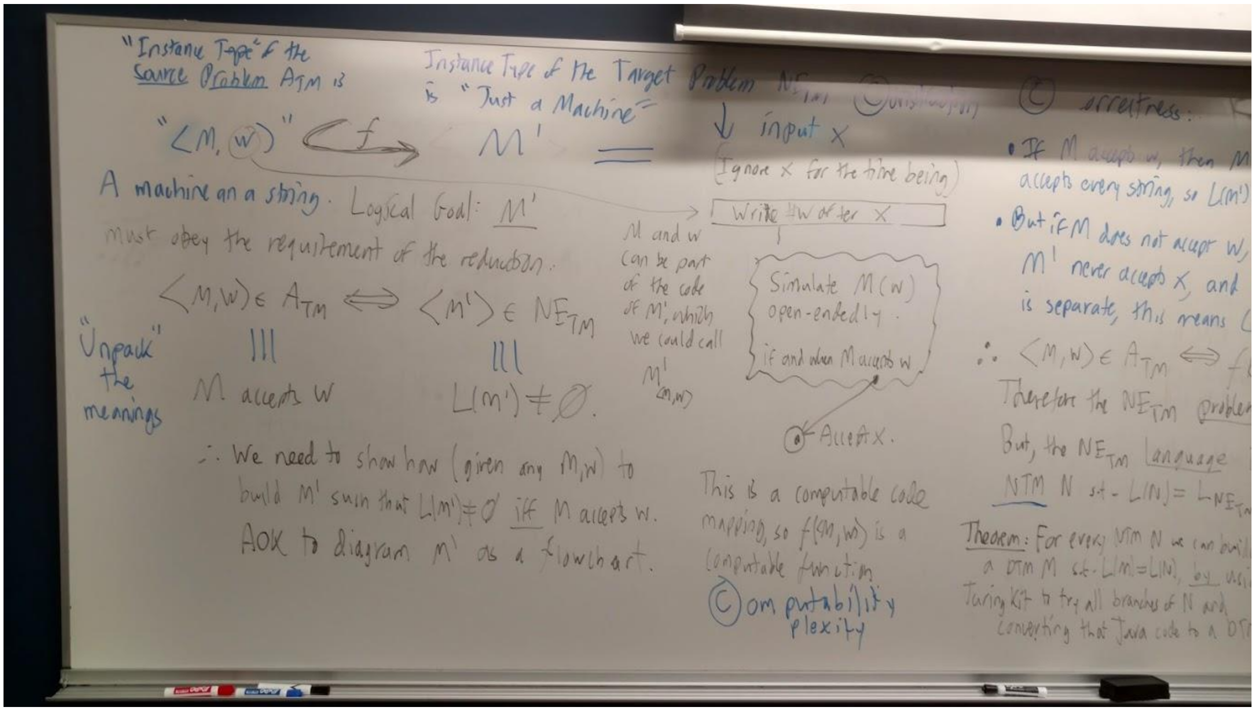
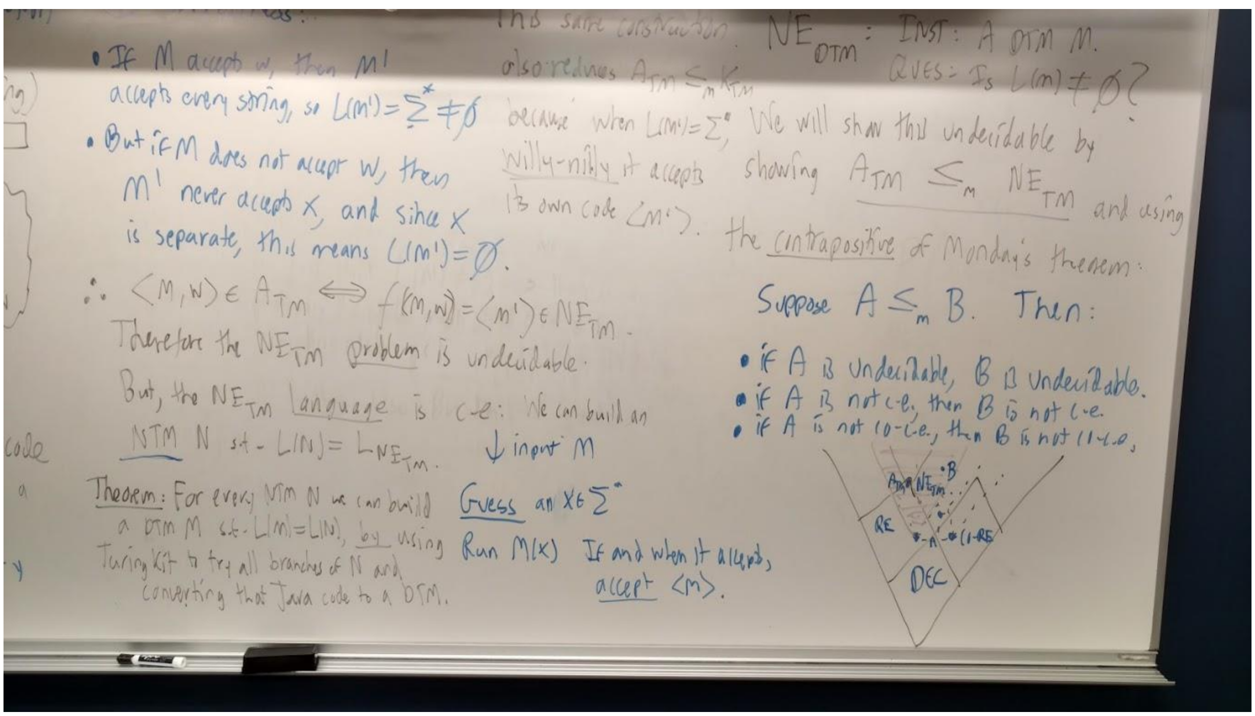
CSE596 lecture Wed. Oct. 2





The missing text for NE_DFA at top is “INST: Just a DFA M (no string w)” and for NE_DTM the missing text is “INST: A deterministic TM M”.


"Instance Type" of the Source Problem ATM is
"⟨M, w⟩"
Instance Type of the Target Problem
is "Just a Machine"
M'
A machine an a string. Logical Goal: M'
must obey the requirement of the reduction:
⟨M,w⟩ ∈ ATM ⟺ ⟨M'⟩ ∈ NETM
"Unpack" the meanings
M accepts w
L(M') ≠ ∅.
∴ We need to show how (given any M,w) to
build M' such that L(M') ≠ ∅ iff M accepts w.
AOK to diagram M' as a flowchart.
↓ input x
(Ignore x for the time being)
Write #w after x
M and w can be part of the code of M', which we could call M'⟨M,w⟩
Simulate M(w) open-endedly.
if and when M accepts w
Accept x.
This is a computable code mapping, so f(⟨M,w⟩) is a computable function.
Computability
plexity
Correctness:
• If M accepts w, then M'
accepts every string, so L(M')
• But if M does not accept w,
M' never accepts x, and
is separate, this means
Therefore the NETM problem
But, the NETM language
NTM N s.t. L(N) = LNETM
Theorem: For every NTM N we can build
a DTM M s.t. L(M)=L(N), by using
Turing Kit to try all branches of N and
converting that Java code to a DTM

• If M accepts w, then M'
accepts every string, so L(M') = Σ* ≠ ∅
• But if M does not accept w, then
M' never accepts x, and since x
is separate, this means L(M') = ∅.
∴ ⟨M,w⟩ ∈ ATM ⟺ f(⟨M,w⟩) = ⟨M'⟩ ∈ NETM.
Therefore the NETM problem is undecidable.
But, the NETM language is c.e.: We can build an
NTM N s.t. L(N) = LNETM.
↓ input M
Guess an x ∈ Σ*
Run M(x) If and when it accepts,
accept ⟨M⟩.
Theorem: For every NTM N we can build
a DTM M s.t. L(M)=L(N), by using
Turing Kit to try all branches of N and
converting that Java code to a DTM.
This same construction
also reduces ATM ≤m KTM
because when L(M')=Σ*, willy-nilly it accepts its own code ⟨M'⟩.
NEDTM: INST: A DTM M.
QUES: Is L(M) ≠ ∅?
We will show this undecidable by
showing ATM ≤m NETM and using
the contrapositive of Monday's theorem:
Suppose A ≤m B. Then:
• if A is undecidable, B is undecidable.
• if A is not c.e., then B is not c.e.
• if A is not co-c.e., then B is not co-c.e.
RE
DEC
NETM
B
A
co-RE