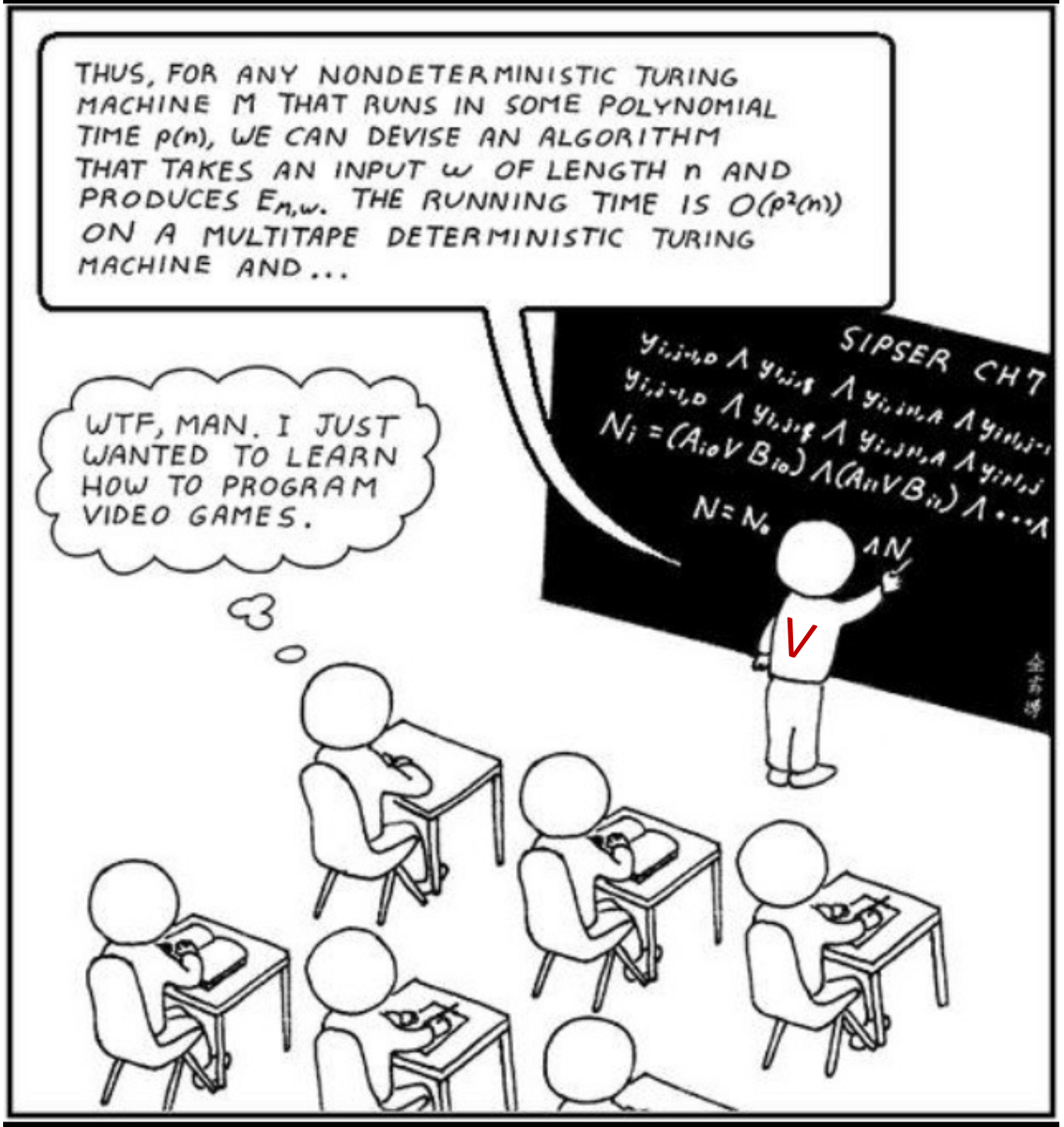
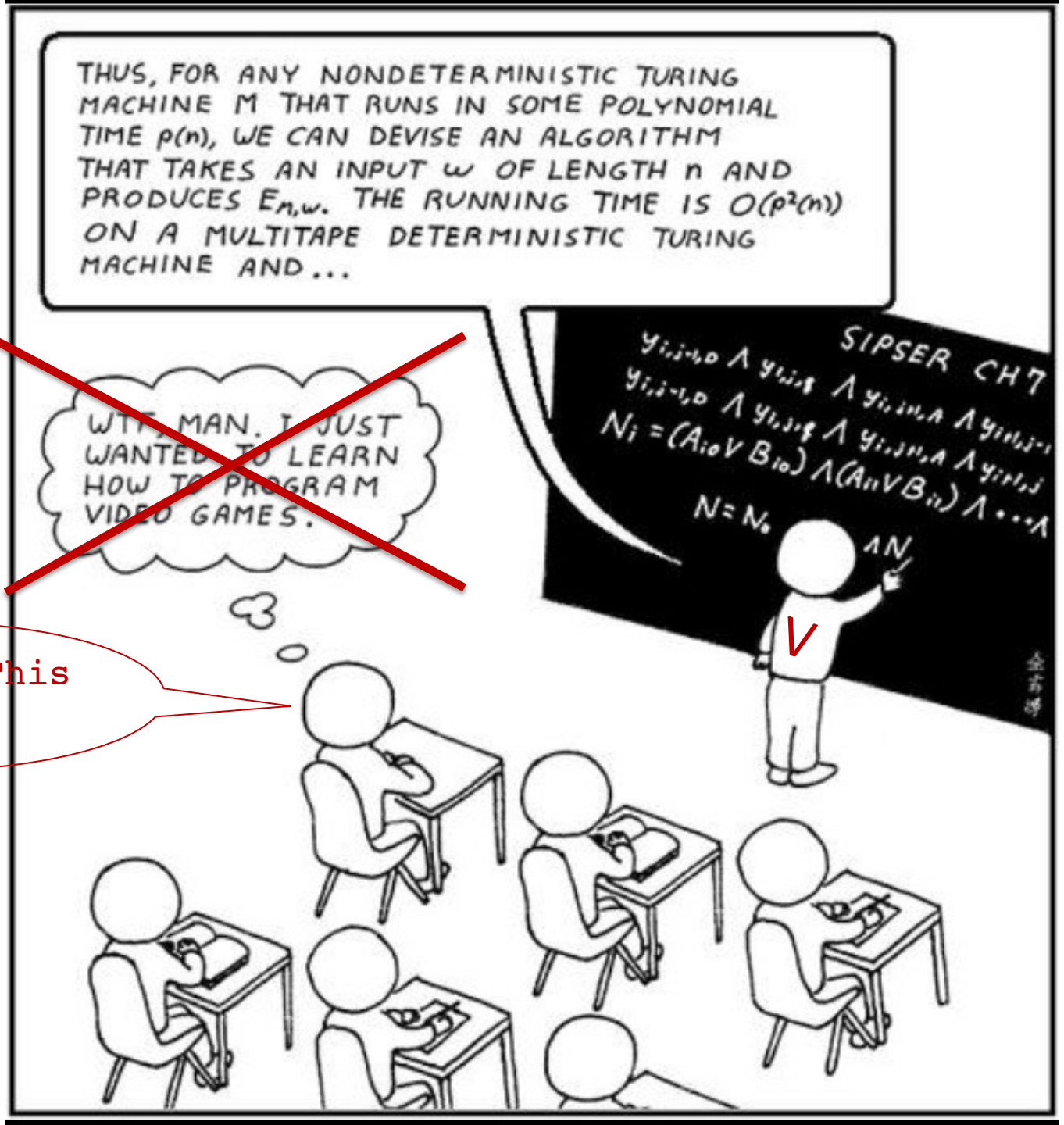
Welcome to CSCC63!

Course web page:

- https://www.cs.toronto.edu/~vassos/teaching/c63
- Password-protected areas:
  - Username: `student`
  - Password: `C63EZPZ`
- Read the course policies carefully and observe them!
- Consult the tentative course calendar frequently
- Piazza:
  https://piazza.com/utoronto.ca/winter2025/cscc63h3slec01/home


THUS, FOR ANY NONDETERMINISTIC TURING MACHINE M THAT RUNS IN SOME POLYNOMIAL TIME p(n), WE CAN DEVISE AN ALGORITHM THAT TAKES AN INPUT w OF LENGTH n AND PRODUCES $E_{M,w}$. THE RUNNING TIME IS $O(p^2(n))$ ON A MULTITAPE DETERMINISTIC TURING MACHINE AND...
WTF, MAN. I JUST WANTED TO LEARN HOW TO PROGRAM VIDEO GAMES.
SIPSER CH7
$N = N_0 \wedge N$
V


THUS, FOR ANY NONDETERMINISTIC TURING MACHINE M THAT RUNS IN SOME POLYNOMIAL TIME p(n), WE CAN DEVISE AN ALGORITHM THAT TAKES AN INPUT w OF LENGTH n AND PRODUCES $E_{M,w}$. THE RUNNING TIME IS $O(p^2(n))$ ON A MULTITAPE DETERMINISTIC TURING MACHINE AND...
WTF, MAN. I JUST WANTED TO LEARN HOW TO PROGRAM VIDEO GAMES.
SIPSER CH7
$N = N_0 \wedge N$
V
Wow, man. This is AWESOME!

The Barber's Paradox

A village where the (male) barber shaves all the men who don't shave themselves.

Q: Does the barber shave himself?

The Liar's Paradox (Epimenides)

This statement is false.

Q: Is this statement true or false?

Russell's Paradox (1901)

Let R be the set of all sets that are not members of themselves.

$R = \{X : X \notin X\}$

Q: Is R a member of itself?

$R \in R$?

Gödel's Incompleteness Theorem (1931)

This statement is unprovable.

Q: Is this statement provable?

Conclusion: Every axiom system (powerful enough to express arithmetic with $+$ and $\times$) is

- either incomplete (can't prove true facts)
- or inconsistent (can prove false facts)

Countability of $\mathbb{N}\times\mathbb{N}$