

# CS3509 Tutorial 1

Tuesday 17th October, 2017

Q: Demonstrate that there is no program that decides whether input programs terminate on input 0.

- a) Assume the program does exist.
  - Call the program H0. We'll show that we could use it to solve the halting problem.
- b) Define a new program Q.
  - Q is identical to P, except that whatever input it's given, it always runs P on i, ignoring its own input.
- c) [Q has solved the halting problem]

Q: Demonstrate there is no program ... on input 10.

- a) Assume the program does exist.
  - Call it H0
- b) Define Q.
  - Q ignores its input, and runs P(i)
  - Q(10) terminates if and only if P(i) terminates
  - Since H0 can tell if Q(10) terminates, H0 can tell if P(i) terminates, which means it has solved the problem
- c) H0 has solved the halting problem, which is impossible – contradiction.

## Problem 1 (page 64)

- a) Assume T exists.
- b) T can solve the halting problem.
  - If T can show how many 5s are output, then it can show whether any number of 5s is output.

- So  $T$  can solve the problem above.
- So  $T$  can solve the halting problem (by our reasoning above).