Halting Problem

The Halting Problem: on input M, w does TM M halt on string w.

FACT: Halting Problem is not decidable.

PROOF:

Take M and reprogram (if necessary) so that whenever tries to go to stop-and-reject, it just moves head right forever instead.

So M accepts w $\iff$ M halts on w.

So if we could solve the Halting Problem then we could solve the Acceptance problem. But we know the latter is undecidable.

So the former is too.