(1) Let 
\[ L = \{ \langle M \rangle \mid M \text{ is a Turning machine that accepts at least one of its inputs} \} \].

(a) Use the fact that \( A_{TM} \) is undecidable to prove that \( L \) is undecidable: assume that \( L \) is decidable by some (Turing machine) algorithm, and explain how you can use this algorithm as a subroutine to decide \( A_{TM} \). [On 10.22 we proved that \( HALT_{TM} \) was undecidable by a similar method.]

(b) Is \( L \) recognizable? Explain.

(c) Is the complement of \( L \) recognizable? Explain.

(2) Is NP is closed under concatenation? Explain.

(3) Is NP closed under intersection? Explain.

(4) Show that if \( P = NP \), then the complement of SAT lies in NP. [As of today, we do not know whether or not the complement of SAT lies in NP.]