MAU22C00: TUTORIAL 21 PROBLEMS
TURING MACHINES

1) Recall the Turing machine constructed in lecture that decides the language $L = \{0^m 1^m \mid m \in \mathbb{N}, m \geq 1\}$. For input string 0011, write down each configuration in turn starting with the initial configuration of the Turing machine and ending with the accepting configuration.

2) (Annual Exam 2020) Let L_1 and L_2 be two Turing-recognisable languages over the same finite alphabet A. Construct an enumerator that outputs $L_1 \cap L_2$.

3) Recall Hilbert's 10th Problem from lecture. What is the size of D_1? Finite, countably infinite or uncountably infinite? Remember that each polynomial in D_1 has integer coefficients.

4) (Annual Exam 2020) In lecture, we defined the language

$$E_{DFA} = \{\langle B \rangle \mid B \text{ is a DFA and } L(B) = \emptyset\}$$

when we examined whether the emptiness testing problem for deterministic finite state acceptors was a Turing-decidable language. Is E_{DFA} finite, countably infinite, or uncountably infinite? Justify your answer.