Introduction to Computation and Complexity
Exercise Sheet 1

Adrien Pommellet, EPITA

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Exercise 1

We want to implement the *shifting over* operation, that is, inserting an extra cell at the current head position. Obviously, we cannot directly edit the tape this way. Nonetheless, design M such that for $w, w' \in \{0,1\}^*$, $wq_0w' \vdash_M^* wq_aBw'$.

Exercise 2

Design a Turing machine M such that M reverses its input, i.e. for $w \in \{0,1\}^*$, $q_0w \vdash_M^* q_aw^R$, where w^R is the reverse of the word w.

Exercise 3

We consider the class of Turing machines with a *semi-infinite* tape. Prove informally that any Turing machine can be simulated by a Turing machine with a semi-infinite tape.

Hint: almost each cell of the semi-infinite tape can feature two sub-cells.