

COMP 335 Worksheet

Turing Machines

1. Let $\Sigma = \{a, b\}$. Find Turing machines that accept the following languages:

- (a) $\{a^n b^n c^n d^n \mid n \geq 0\}$
- (b) $\{w \mid w \in (a+b)^*, w = w^R\}$
- (c) $\{ww^R \mid w \in (a+b)^*\}$
- (d) $\{wcw \mid w \in (a+b)^*\}$
- (e) $\{ww \mid w \in (a+b)^*\}$

2. Explain how to construct a TM that would accept the following languages:

- (a) $\{a^n \mid n \text{ is prime}\}$
- (b) $\{a^{n^2} \mid n \geq 1\}$

3. Find Turing machines that compute the following functions:

- (a) $f(1^m 0 1^n) = 1^{m+n}$
- (b) $f(w) = ww$ where $w \in (a+b)^*$
- (c) $f(1^n) = f(1^{3n})$
- (d) $f(1^m 0 1^n) = 1$ if $m \geq n$ and 0 otherwise.
- (e) $f(1^m 0 1^n) = 1^{m+n}$ if $m \geq n$ and 0 otherwise.
- (f) $f(1^n) = 1^{n^2}$