Problem Sheet 2

January 29, 2017

1. Which of the following languages are regular? Prove your answer.
   (a) $\{xx^Rw|x, w \in (0 \cup 1)^*\}$
   (b) $\{0^{2n}|n \geq 1\}$
   (c) $\{0^i1^m2^m|i \geq 1, m \geq 1\}$
   (d) $\{0^i1^j|gcd(i, j) = 1\}$
2. Let L be a language. Define $\frac{1}{2}(L)$ to be $\{x|$for some y such that $|x| = |y|,\ xy \in L\}$. That is $\frac{1}{2}(L)$ is the first halves of stings in L. prove for each regular L that $\frac{1}{2}(L)$ is regular.
3. Give a decision procedure to determine if the set accepted by a DFA is
   (a) the set of all strings over a given alphabet.
   (b) *cofinite* (a set whose complement is finite).