**Formal Language Selected Homework Chapter 3.1**

**2.** Does the expression $((0+1)(0+1)^*)^* 00(0+1)^*$ denote the language in Example 3.5?

**4.** Find a regular expression for the set $\{a^n b^m : n \geq 3, m \text{ is even}\}$.

**5.** Find a regular expression for the set $\{a^n b^m : (n+m) \text{ is even}\}$.

**6.** Give regular expressions for the following languages.

(a) $L_1 = \{a^n b^m, n \geq 4, m \leq 3\}$.

(c) The complement of $L_1$.

**10.** Give a regular expression for $L = \{a^n b^m : n \geq 1, m \geq 1, nm \geq 3\}$.

**13.** Find a regular expression for $L = \{vwv : v, w \in \{a,b\}^*, |v| = 2\}$.

**16.** Give regular expressions for the following languages on $\Sigma = \{a, b, c\}$.

(a) all strings containing exactly one $a$,

(b) all strings containing no more than three $a$'s,

(c) all strings that contain at least one occurrence of each symbol in $\Sigma$,

**17.** Write regular expressions for the following languages on $\{0, 1\}$.

(a) all strings ending in 01,

(b) all strings not ending in 01,

(c) all strings containing an even number of 0's,

**18.** Find regular expressions for the following languages on $\{a, b\}$.

(a) $L = \{w : |w| \bmod 3 = 0\}$.

(b) $L = \{w : n_a(w) \bmod 3 = 0\}$.

**23.** For the case of a regular expression $r$ that does not involve $\lambda$ or $\varnothing$, give a set of necessary and sufficient conditions that $r$ must satisfy if $L(r)$ is to be infinite.

**25.** In Exercise 24, what are sufficient conditions on the expression so that the picture is a closed contour in the sense that the beginning and ending points are the same? Are these conditions also necessary?

**26.** Find an nfa that accepts the language $L(aa^*(a+b))$.

**27.** Find a regular expression that denotes all bit strings whose value, when interpreted as a binary integer, is greater than or equal to 40.