

## Mid-term Examination

Wednesday, November 5, 9:30–10:20 a.m.

### Question 1 (30 points)

Let  $X = (\{1\}\{0\}^*\{1\} \cup \{2\}\{0\}^*\{2\})^*$ .

(a) Find an FA  $M$  such that  $L(M) = X$ . [20 points]

(b) For each  $q \in Q_M$ , describe  $\Lambda_q$  as simply as possible, without mentioning  $M$ . [10 points]

### Question 2 (20 points)

Find a regular expression  $\alpha$  such that  $L(\alpha) = \{w \in \{0,1\}^* \mid 00 \text{ is not a suffix of } w\}$ .

### Question 3 (50 points)

Let

$$\alpha = (0 + 01)^*,$$

$$X = \{w \in \{0,1\}^* \mid 1 \text{ is not a prefix of } w \text{ and } 011 \text{ is not a substring of } w\}.$$

Prove that  $L(\alpha) = X$ .