Exercise 7.1 (Regular expressions, 0.5 + 0.5 + 0.5 + 0.5 + 0.5 + 0.5 marks)
Consider the following regular expressions. Give two strings that are members of the corresponding language and two strings which are not members – a total of four strings for each part. Assume the alphabet $\Sigma = \{a, b\}$ in all parts.

(a) $a(ba)^*b$
(b) $a^* \cup b^*$
(c) $\Sigma^*a\Sigma^*b\Sigma^*a\Sigma^*$
(d) $aba \cup bab$
(e) $(\epsilon \cup a)b$
(f) $(a \cup ba \cup bb)\Sigma^*$

Exercise 7.2 (Regular Expressions, 0.5 + 0.5 + 1 + 1 marks)
Find regular expressions describing filenames, that

(a) end with .tex or .dvi,
(b) contain exactly one dot (.),
(c) have at least one letter before the last dot (.), and
(d) do not contain the substring ox.

Use the normal English alphabet as well as the symbols ., −, and _ i.e. $\Sigma = \{a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z, -, \_\}$. You can use $\{a \rightarrow z\}$ to denote the normal alphabet, or $\{a \rightarrow b, d \rightarrow z\}$ to denote the normal alphabet without the letter $c$ (This is an example!), or use $\{a \rightarrow z\} \setminus \{c\}$.

Exercise 7.3 (NFAs and Regular Expressions, 2.5 + 1.5 marks)
Consider the regular expression $(30 \cup 75 \cup 45)^* \circ 10$ (over the alphabet $\Sigma = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$).

(a) Give the NFA that recognizes $L((30 \cup 75 \cup 45)^* \circ 10)$ as it would be constructed according to the proof of Lemma 1.29 from the lecture.

(b) Give another NFA with at most 5 states that recognizes the same language (you do not have to justify your answer).