Homework 7
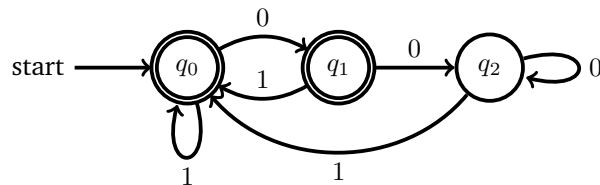
1. Suppose the following finite deterministic automaton over the alphabet $\{0,1\}$.

   Give a regular expression that can recognise the same language as this automaton. (Hint: If you use Brzozwski's method, you can assume Arden's lemma which states that an equation of the form $q = q \cdot r + s$ has the unique solution $q = s \cdot r^*$.)

2. Consider the following grammar

$$S \to N \cdot P$$
$$P \to V \cdot N$$
$$N \to N \cdot N$$
$$N \to A \cdot N$$
$$N \to \texttt{student} \mid \texttt{trainer} \mid \texttt{team} \mid \texttt{trains}$$
$$V \to \texttt{trains} \mid \texttt{team}$$
$$A \to \texttt{The} \mid \texttt{the}$$

   where S is the start symbol and S, P, N, V and A are non-terminals. Using the CYK-algorithm, check whether or not the following string can be parsed by the grammar:

   ```
   The trainer trains the student team
   ```

3. **(Optional)** The task is to match strings where the letters are in alphabetical order—for example, `abcfjz` would pass, but `acb` would not. Whitespace should be ignored—for example `ab c d` should pass. The point is to try to get the regular expression as short as possible! See:

   `http://callumacrae.github.com/regex-tuesday/challenge11.html`