Exercise 1 Specify an automaton over the alphabet \{a, b, c\} which accepts the words of the language with the following properties:
(1) a word starts with at most two \(a\)
(2) \(a \, c\) is always followed by an even number of \(b\) (0 is even)
(3) each word has at least size 1
(4) there are no other restrictions on the words

Examples: \(aa\), \(baa\), \(aachbaacbbcbbbbb\), ...

1. Graphically specify the automaton which accepts exactly the words described above.
2. Is the automaton deterministic?
3. Is the automaton complete?
4. Formally specify the automaton as a 5-tuple, including all of its components.

Exercise 2
Specify an automaton which describes the (simplified) structure of valid method signatures in Java-like programming languages according to following specification:

1. optional modifier \texttt{public}, \texttt{private}, \texttt{protected}
2. return type \texttt{void} or data type
3. method name
4. parameter list in brackets which can either be empty or which can contain multiple “data-type parameter-name”-pairs separated by a comma.

For simplification, we consider only data types \texttt{Object}, \texttt{int}, and \texttt{boolean}. Method names and parameter names are strings consisting of letters a, b, c and numbers 1, 2. The first symbol of a name is a name is a letter. White spaces do not have to be considered.
Examples:

- `public void abcl (Object a, boolean b)`
- `Object bb ()`

**Exercise 3**

Draw an FA $A$ with input-alphabet $\Sigma := \{a, b\}$ having exactly 3 states such that...

1. $A$ is non-deterministic and incomplete.
2. $A$ is deterministic and incomplete.
3. $A$ is non-deterministic and complete.
4. $A$ is deterministic and complete.

Justify each of your solutions.

**Exercise 4**

Let $P_3 := A_3 \times A_4$ be the product automaton of FA $A_3$ and FA $A_4$ as shown on the right. Draw $P_3$ and fully specify it formally as a 5-tuple. Find three words $w$ with $w \in L(P_3)$. What is the maximum number of states $P_3$ can have in theory? Justify your answers.