(a) Let $L$ be the set of all strings over the alphabet $\{a, b\}$ that end in $a$ and do not contain the substring $bb$. Describe a deterministic finite automaton whose language of accepted strings is $L$. Justify your answer. [5 marks]

(b) Explain what is meant by a regular expression $r$ over an alphabet $\Sigma$ and by the language $L(r)$ determined by $r$. [6 marks]

If a regular expression $r$ does not contain any occurrence of the symbol $\emptyset$, is it possible for $L(r)$ to be empty? [2 marks]

Explain why it is always possible, given a regular expression $r$ over $\Sigma$, to find a regular expression $\sim r$ with the property that $L(\sim r)$ is the set of all strings over $\Sigma$ that are not in $L(r)$. Any standard results you use should be carefully stated, but need not be proved. [7 marks]