1995 Paper 2 Question 27

Regular Languages and Finite Automata

Prove or disprove each of the following statements, stating clearly any well known results that you use.

(a) The set of strings over the alphabet $\{0, 1\}$ that contain exactly twice as many occurrences of 0 as of 1 is a regular language;

(b) Let L be a regular language over an alphabet Σ. Then the language consisting of those $u \in \Sigma^*$ such that there is some $v \in \Sigma^*$ with $uv \in L$, is also a regular language;

(b) Any finite subset of $\{a, b\}^*$ is a regular language;

(d) For any regular expressions $\mathbf{r}$ and $\mathbf{s}$, the regular expressions $(\mathbf{r}^*\mathbf{s}^*)^*$ and $(\mathbf{r}|\mathbf{s})^*$ always denote the same language.

[20 marks]