

## 2002 Paper 2 Question 9

### Regular Languages and Finite Automata

State, with justification, whether or not each of the following languages over  $\Sigma = \{a, b\}$  is regular. Any standard results you use should be clearly stated, but need not be proved:

- (a)  $\{a^m b^n \mid m, n \in \mathbb{N}\}$  ; [3 marks]
- (b)  $\{a^m b^n \mid m \leq n\}$  ; [5 marks]
- (c)  $\{a^m b^n \mid m + n \leq 4\}$  ; [2 marks]
- (d)  $\{w \in \Sigma^* \mid w \notin L\}$ , where  $L$  is some given language which *is* regular; [4 marks]
- (e)  $\{w \in \Sigma^* \mid w \notin L\}$ , where  $L$  is some given language which *is not* regular; [2 marks]
- (f) some infinite subset of the language given in part (b). [4 marks]