1993 Paper 6 Question 12

Formal Languages and Automata

For each of the following languages over the alphabet $\{a, b\}$, say whether or not it is regular. Justify your answers stating clearly any results that you use.

(*a*) The set of all strings which are not palindromes (i.e. which are not equal to their own reverse) [4 marks]

(*b*) The union of countably many regular languages $L_1, L_2, L_3, \ldots$ [4 marks]

(*c*) The set of all strings in which the number of occurrences of the letter a and the number of occurrences of the letter b are both divisible by 3 [4 marks]

(*d*) The set of all strings which are of the form ww for some string w [4 marks]

(*e*) The set of all strings such that in each initial substring the number of occurrences of the letter a and the number of occurrences of the letter b differ by no more than 2 [4 marks]