2007 Paper 4 Question 3

Prolog

Short Message Service (SMS) texts replace lists of three characters with single characters to be able to represent the information in as few characters as possible when typing on a phone keyboard. For example, "See you later, Kate" becomes `C u l8r k8`. This question asks you to create predicates in Prolog to implement this translation and to describe how they work using the examples given.

Your answers should use minimal backtracking but should achieve this without using the cut operator.

(a) Write a predicate
    `replace(OldCharacter, NewCharacter, InputList, OutputList)`
    that replaces all the occurrences of `OldCharacter` in `InputList` with `NewCharacter`. For example, `replace(a,x,[b,a,n,a,n,a], Answer)` unifies `Answer` with `[b,x,n,x,n,x]`. [2 marks]

(b) Explain how your `replace` program produces this output, showing carefully how and when backtracking and unification occur. [2 marks]

(c) Describe the *two* circumstances where the cut operator is recommended when using Prolog as a "pure" logic language. [2 marks]

(d) Write a predicate `textify(ListToReplace, NewCharacter, InputList, OutputList)` that replaces all the occurrences of `ListToReplace` in `InputList` with the character `NewCharacter`. Assume that `ListToReplace` always has exactly three characters.

   For example, `textify([a, t, e], 8,[s, e, e, ' ', y ,o ,u , ' ', l, a, t, e, r, ' ', k, a, t, e], Answer)` should unify `Answer` with `[s, e, e, ' ', y, o, u, ' ', l, 8, r, ' ', k, 8]`. [5 marks]

(e) Explain how your `textify` program produces this output, showing carefully how and when backtracking and unification occur. [4 marks]

(f) Provide the calls to `textify` to replace `[a,t,e]` with 8, `[s,e,e]` with c and `[y,o,u]` with u for the `InputList` `[s, e, e, ' ', y ,o ,u , ' ', l, a, t, e, r, ' ', k, a, t, e]`. [3 marks]

(g) Describe how you would modify `textify` to deal with lists of any length. [2 marks]