10 Prolog (acr31)

When answering this question you should ensure that each of your predicates has a comment giving a declarative reading of its behaviour and you should avoid unnecessary use of cut. Your solutions should not use any extra-logical predicates (such as `assertz`).

A map can be used to represent a polynomial where the keys are the exponents and the values are the corresponding coefficients. For example the polynomial $1+3x^2+9x^5$ could be encoded by a map $0\rightarrow1, 2\rightarrow3, 5\rightarrow9$.

(a) Describe a Prolog datastructure you could use to represent a map. Clearly identify your use of atoms and compound terms. [3 marks]

(b) Implement a predicate `put` which associates a given value with a given key, replacing any existing value for that key. [4 marks]

(c) Show how you would use `put` to build a map representing the polynomial $1 + 3x^2 + 9x^5$. [1 mark]

(d) Implement a predicate `lookup` which finds the value associated with a given key in the map. If the key is not present then the result of the `lookup` should be 0.

[5 marks]

(e) Using `put` and `lookup` or otherwise, implement a predicate `polyadd` which adds two polynomials together. Your predicate should be amenable to Last Call Optimisation. [7 marks]