Controllers for Generalized Planning

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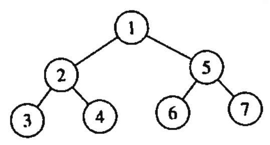

Figure 1: Example of a binary tree with seven nodes.

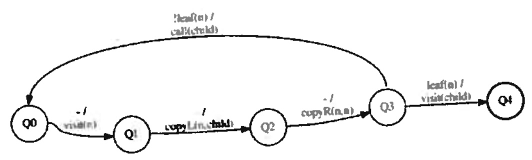

Figure 2: Hierarchical FSC $C[n]$ that traverses a binary tree.

In this paper we introduce a novel formalism for representing and computing compact and generalized planning solutions that we call *hierarchical FSCs*. Our formalism extends standard FSCs for planning in three ways. First, a hierarchical FSC can involve multiple individual FSCs. Second, each FSC can call other FSCs. Third, each FSC has a parameter list, and when an FSC is called, it is necessary to specify the arguments assigned to the parameters. As a special case, our formalism makes it possible to implement recursion by allowing an FSC to call itself with different arguments.

To illustrate this idea, Figure 2 shows an example hierarchical FSC $C[n]$ that implements DFS traversal of binary trees using recursion. Here, n is the lone parameter of the controller and represents the current node of the binary tree. Condition leaf(n) tests whether n is a leaf node, while a hyphen '-' indicates that the transition fires no matter what. Action visit(n) visits node n, while copyL(n, m) and copyR(n, m) assign the left and right child of node n to m, respectively. Action call(m) is a recursive call to the FSC itself, assigning argument m to the only parameter of the controller and restarting execution from its initial node Q_0.

Intuitively, by repeatedly assigning the right child of n to n itself (using the action copyR(n, n)) and following the cycle of controller states $Q_0, Q_1, Q_2, Q_3, Q_0, \ldots$, the FSC $C[n]$ has the effect of visiting all nodes on the rightmost branch of