

Apparent Nondeterminism in Actions

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Nondeterminism has a central role in computer science, and poses difficulties for many formalisations of domain knowledge in artificial intelligence. In particular, the nondeterminism of actions often complicate the formal treatments of actions. This paper elucidates some possible sources of nondeterminism in theories of actions. The emphasis is on how nondeterminism may arise from inadequacies of the representation language, the identification of which can suggest strategies for reducing or eliminating the apparent nondeterminism.

Keywords: nondeterminism, actions

CR Categories: F.1.2 – Alternation and nondeterminism

1. INTRODUCTION

Nondeterminism occupies a central role in theoretical computer science, perhaps most strikingly as the $P=NP$ question. The issue there is whether the apparent power of nondeterminism is “real”, for if it is demonstrably not the case, we would have efficient algorithms for ostensibly hard problems. It is less well-known that nondeterminism also poses difficulties and challenges in areas where computational efficiency may not be the central issue. This paper focuses on one aspect of this problem, viz, that in which the nondeterminism is apparent only because the domain representation has omitted essential information. It should not be surprising that if some aspects of “reality” are not captured by a formal model, it may prove to be deficient. On the other hand it is impossible for a model to be entirely faithful. The issue is to decide what to omit. Three common omissions that lead to avoidable nondeterminism are addressed in Section 4, viz, that which assumes too simple a

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Manuscript received: July 2001

Associate Editor: Jenny Edwards