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Foreword

This book contains a collection of papers presented at a Research and Development conference of the South African Institute of Computer Scientists and Information Technologists (SAICSIT). The conference was held on 13 & 14 November 1997 at the Riverside Sun, Vanderbijlpark. Most of the organization for the conference was done by the Department of Computer Science and Information Technology of the Vaal Triangle Campus, Potchefstroom University for Christian Higher Education.

The programming committee accepted a wide selection of papers for the conference. The papers range from detailed technical research work to reports of work in progress. The papers originate mainly from Academia, but also describe work done in and for Industry. It is hoped that the papers give a true reflection of the current research scene in Computer Science and Information Technology in South Africa. Since one of the aims of the conference is Research development, the papers were not subjected to a refereeing process.

A number of people spent numerous hours helping with the organization of this conference. In this regard, we wish to thank the members of the Organizing committee, and the Programming committee who had very little time to screen the abstracts and compile the program. A special thanks goes to the secretary of the department, Mrs Helei Jooste, whose very able work was interrupted by the birth of her first child.
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A Distributed Approach to the Scheduling Problem

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The focus of many Artificial Intelligence approaches to solving the computer-based scheduling problem is on reducing the size of the search spaces that characterise such problems. The approach presented in this paper decomposes the scheduling problem and distributes a series of subproblems to autonomous agents which construct the schedule collectively through negotiation. Negotiation has been a key area in Distributed Artificial Intelligence research and although many applications have been developed using it as a model for cooperative problem solving, none have addressed the problem of scheduling. All scheduling problems consist of a set of objects that have to pass through a set of processes. In a job shop situation, the objects are the items being manufactured and the processes are the physical operations such as drilling, welding and so on. University timetabling is a special case of scheduling where the objects are students and the processes are the lectures which have to be attended in a given week. While the distributed approach is applicable to all classes of the scheduling problem, it is illustrated here in the area of timetabling.

The system consists of a controlling agent and a network of intelligent agents which communicate through a blackboard. Each agent in the network represents a process venue, typically a lecture room. Each individual agent’s knowledge consists of all the attributes of the venue that it represents as well as the course/event allocations that have been made to it at any point during the construction of the timetable. The controlling agent keeps a list of all the events that have to be scheduled in random order. Venue-related constraint knowledge is held by the individual agents while global constraints such as event clashes are held by the controlling agent. For each time slot (session), the controller selects an event to be scheduled and broadcasts a bid specification message over the network. Each agent representing a venue whose attributes satisfy the message requirements submits a bid. The bid is simply a value that reflects the appropriateness of the venue for the event. It is a cost score made up of penalties for excess capacity, distance etc. The controller evaluates all the submitted bids by sorting the values and awarding the event to the agent with the lowest bid. Since only those agents who are capable of hosting the event submit bids, the award is made to the most appropriate (cost effective) venue. Once an agent has been awarded an event, it withdraws from the process unless a type 2 message is broadcast. When all the venues have been awarded bids, the controller repeats the process for the next time slot. There are considerable advantages in using a distributed system for timetabling. These, as well as the construction of the prototype system will be discussed.