

exemplary, but non-Congressional readers should bear in mind that that is its aim and context, and not look for more than broad-brush speculation on future developments.

The publication is expensive but rich in data. Anyone interested in U.S. activity in computers and telecommunications (is there anyone who is not?) should examine the report, both for their own information and to see upon what evidence Congressional decisions concerning I.T. R & D will be based.

GILLIAN BULL

**Computer Scheduling of Public Transport 2**

JEAN-MARC ROUSSEAU (Editor)

Elsevier Science, North-Holland, Amsterdam, 1985. 512 pp. U.S.\$59.25

ISBN 0 44487778 9

This long book is a record of an international state-of-the-art workshop on bus and crew scheduling problems, held in Montréal in 1983. The work of masters and apprentices is included in the papers, which are classified into six sections.

Section I (116 pages) includes non-mathematical descriptions of the following, off-the-shelf, bus and crew scheduling computer packages: SAGE (U.S.), HASTUS (Canada), RUCUS II (U.S.) and BUSMAN (U.K.). They are modular, interactive packages combining heuristic and mathematical programming techniques with carefully designed man-machine interfaces and report generation facilities. HASTUS has saved "over two million dollars a year in Montréal". RUCUS II was released by the U.S. Department of Transportation. BUSMAN is the product of Wootton Jeffreys and the Wren group at Leeds University. In 1983, BUSMAN was used by five major bus operators in the U.K.: W.M.P.T.E., M.P.T.E., L.C.B.S., S.Y.P.T.E. and STRATHCLYDE P.T.E. The marketing module of BUSMAN can provide neighbourhood "Yellow Pages of Public Transportation", which may be funded from advertising revenue.

Section II (92 pages) includes three papers on the application in Quebec, Paris and California of the HASTUS system to evaluate the crew cost implications of changes to the drivers' union agreement. In the Paris and Quebec cases, the impact on bargaining meetings with the union side was noted. The other papers in Section II describe the vehicle and crew scheduling systems in Brussels, Shanghai and Amsterdam.

Section III (102 pages) includes several mathematical approaches to the crew scheduling problem, and it will be of interest to academics who lecture on mathematical programming. The approaches available with and being developed for the HASTUS, RUCUS II and BUSMAN packages are described.

The work on the rostering problem described in Section IV (14 pages) is disappointing, although the work of Belletti et al., implemented in Florence, is impressive.

Section V (18 pages) is a detailed proposal for a relational database to be at the heart of RUCUS II.

Section VI (168 pages) is concerned with various aspects of vehicle scheduling. Traditionally, vehicle scheduling is done before crew scheduling. The eight papers in this section are very varied. Most of them involve mathematical programming. The curate's egg paper, on bus scheduling in Paris, includes an interesting approach to layover times and an incredible measure, T.O.V., of service quality, which attempts to incorporate crowding of buses with average waiting time of passengers.

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