Software Section

Obtaining Test Problems via Internet

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Abstract. In this paper we detail a number of sources of test problems accessible via Internet. We also outline a number of ways by which such test problems can be obtained, for example by electronic mail (email), anonymous file transfer protocol (anonymous ftp), Gopher, Veronica and via the World Wide Web (WWW) using browsers such as Mosaic and Netscape.

Key words: Test problems, Internet.

1. Introduction

One problem faced by developers of algorithms is that of obtaining test problems which can be used to compare their algorithms with those of other researchers. In this paper we outline a number of ways by which test problems can be obtained via Internet. We first detail the test problem library (OR-Library), accessible via Internet, maintained by the author. We then outline different ways by which Internet resources can be accessed and finally go on to consider different sources of test problems.

2. OR-Library

OR-Library has details of test problems available for a large number of optimisation problems. Specifically it has details of test problems for assignment, crew scheduling, data envelopment analysis, generalised assignment, integer programming, linear programming, location (capacitated, p-median and uncapacitated), matching, maximum clique, multiple knapsack, network flow, quadratic assignment, resource constrained shortest path, scheduling (flow shop, job shop and open shop), set covering, set partitioning, Steiner tree problems (Euclidean, rectilinear and in graphs), time series forecasting, travelling salesman, two-dimensional cutting (assortment, constrained guillotine, constrained non-guillotine and unconstrained guillotine) and vehicle routing (fixed areas, fixed routes, period routing, single period and sparse feasibility graph). OR-Library is maintained by the author of this paper and researchers with publicly available test problems are invited to
contact him (j.beasley@ic.ac.uk) so that a reference to their test problems can be included in OR-Library.

3. Internet Resource Access

As readers may be aware there has recently been a rapid increase in the number of users of Internet, as well as continuing evolution in the software tools used to access Internet resources. In this paper we briefly outline a number of such tools and illustrate their application by reference to OR-Library. More information about these tools and their general use can be found in [1,2].

Electronic mail (email) is the simplest Internet resource access tool. Typically the user simply sends an email message requesting certain files/information to an email address and the required files/information are sent by return email. For example emailing the message info to o.rlibrary@ic.ac.uk returns information about the current contents of OR-Library.

Anonymous file transfer protocol (anonymous ftp) is a more complex Internet resource access tool. With it the user accesses (as an anonymous user) another computer and transfers files. Figure 1 illustrates an anonymous ftp session, with appropriate annotations, for OR-Library.

Email and anonymous ftp require relatively technically sophisticated users. There are a number of tools for accessing Internet resources that are more menu-driven and which attempt to hide technical complexities from the user, among these tools are Gopher, Veronica, Mosaic and Netscape.

Gopher is an interactive system that offers menu-based capabilities for accessing Internet resources. A related tool is Veronica which offers a keyword search of the Internet resources known to Gopher.

Readers of this paper may well have Gopher and Veronica available on their own systems. If not, then a publically available Gopher/Veronica system can be reached by telnet (the Internet tool that allows a user to log into a remote computer). Simply telnet to uxl.cso.uiuc.edu and login as gopher.

The World Wide Web (WWW) is an emerging linking of Internet resources via hypertext documents—documents (files) with explicit links to other documents (wherever they may reside on Internet). One specific tool for accessing WWW documents is Mosaic. Mosaic is a graphical, mouse driven, tool (as opposed to the previous mentioned tools, Gopher and Veronica, which are essentially command line driven menus). Such graphical tools are typically known generically as browsers. Netscape is another popular browser. Readers without Mosaic (or any other WWW access tool) available on their own systems can access information about the WWW and available WWW access tools by telnet to telnet.w3.org.