506 System Dependencies

Components of computer systems often have dependencies—other components that must be installed before they will function properly. These dependencies are frequently shared by multiple components. For example, both the TELNET client program and the FTP client program require that the TCP/IP networking software be installed before they can operate. If you install TCP/IP and the TELNET client program, and later decide to add the FTP client program, you do not need to reinstall TCP/IP.

For some components it would not be a problem if the components on which they depended were reinstalled; it would just waste some resources. But for others, like TCP/IP, some component configuration may be destroyed if the component was reinstalled.

It is useful to be able to remove components that are no longer needed. When this is done, components that only support the removed component may also be removed, freeing up disk space, memory, and other resources. But a supporting component, not explicitly installed, may be removed only if all components which depend on it are also removed. For example, removing the FTP client program and TCP/IP would mean the TELNET client program, which was not removed, would no longer operate. Likewise, removing TCP/IP by itself would cause the failure of both the TELNET and the FTP client programs. Also if we installed TCP/IP to support our own development, then installed the TELNET client (which depends on TCP/IP) and then still later removed the TELNET client, we would not want TCP/IP to be removed.

We want a program to automate the process of adding and removing components. To do this we will maintain a record of installed components and component dependencies. A component can be installed explicitly in response to a command (unless it is already installed), or implicitly if it is needed for some other component being installed. Likewise, a component, not explicitly installed, can be explicitly removed in response to a command (if it is not needed to support other components) or implicitly removed if it is no longer needed to support another component.

Input

The input will contain a sequence of commands (as described below), each on a separate line containing no more than eighty characters. Item names are case sensitive, and each is no longer than ten characters. The command names (`DEPEND`, `INSTALL`, `REMOVE` and `LIST`) always appear in uppercase starting in column one, and item names are separated from the command name and each other by one or more spaces. All appropriate `DEPEND` commands will appear before the occurrence of any `INSTALL` command that uses them. There will be no circular dependencies. The end of the input is marked by a line containing only the word `END`.

Command Syntax	*Interpretation/Response*
`DEPEND item1 item2 [item3 ...]`	**item1** depends on **item2** (and **item3** ...)
`INSTALL item1`	install **item1** and those on which it depends
`REMOVE item1`	remove **item1**, and those on which it depends, if possible
`LIST`	list the names of all currently-installed components

Output

Echo each line of input. Follow each echoed `INSTALL` or `REMOVE` line with the actions taken in response, making certain that the actions are given in the proper order. Also identify exceptional conditions (see

Sample Output, below, for examples of all cases). For the `LIST` command, display the names of the currently installed components in the installation order. No output, except the echo, is produced for a `DEPEND` command or the line containing `END`. There will be at most one dependency list per item.

Sample Input

```
DEPEND   TELNET TCPIP NETCARD
DEPEND TCPIP NETCARD
DEPEND DNS TCPIP NETCARD
DEPEND  BROWSER   TCPIP  HTML
INSTALL NETCARD
INSTALL TELNET
INSTALL foo
REMOVE NETCARD
INSTALL BROWSER
INSTALL DNS
LIST
REMOVE TELNET
REMOVE NETCARD
REMOVE DNS
REMOVE NETCARD
INSTALL NETCARD
REMOVE TCPIP
REMOVE BROWSER
REMOVE TCPIP
END
```

Sample Output

```
DEPEND   TELNET TCPIP NETCARD
DEPEND TCPIP NETCARD
DEPEND DNS TCPIP NETCARD
DEPEND  BROWSER   TCPIP  HTML
INSTALL NETCARD
   Installing NETCARD
INSTALL TELNET
   Installing TCPIP
   Installing TELNET
INSTALL foo
   Installing foo
REMOVE NETCARD
   NETCARD is still needed.
INSTALL BROWSER
   Installing HTML
   Installing BROWSER
INSTALL DNS
   Installing DNS
LIST
   NETCARD
   TCPIP
   TELNET
   foo
   HTML
   BROWSER
   DNS
REMOVE TELNET
   Removing TELNET
REMOVE NETCARD
   NETCARD is still needed.
REMOVE DNS
   Removing DNS
REMOVE NETCARD
   NETCARD is still needed.
INSTALL NETCARD
   NETCARD is already installed.
REMOVE TCPIP
   TCPIP is still needed.
REMOVE BROWSER
   Removing BROWSER
   Removing HTML
   Removing TCPIP
REMOVE TCPIP
   TCPIP is not installed.
END
```