

# New System Dependencies

## Context:

Components of computer systems often have dependencies—other components that must be installed before they will function properly. Today we're going to implement a simplified package manager.

## Requirements:

Our simple package manager should be able to track and manage dependencies. This includes implicitly installing necessary dependencies and removing components when they are no longer necessary. At any point our manager should also be able to output the currently installed programs.

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.

## Command Structure:

```
DEPEND <package> <dependency1> [<additional dependencies>]
```

Takes 2+ arguments. The first argument, <package>, depends on **all** of the remaining arguments. Note that all depend commands will appear at the beginning of any input file.

Example:

```
DEPEND a b c
```

– <a> depends on <b> and <c>.

```
INSTALL <package>
```

Takes 1 argument. Implicitly install any unmet dependencies, and then explicitly install <package>. If <package> is already installed, echo that feedback.

Example:

```
DEPEND a b
```

```
INSTALL a
```

- implicitly install <b>. Explicitly install <a>

**REMOVE <package>**

Takes 1 argument. If <package> is not installed, echo that feedback. If <package> is still needed as a dependency for other installed packages, echo that feedback, and do not remove <package>. Otherwise, remove <package>. Afterward, remove any implicitly installed packages that are no longer needed by the system.

Examples:

```
DEPEND a b
```

```
INSTALL a
```

```
REMOVE b
```

- echo that <b> is still needed

~~~~

```
DEPEND a b
```

```
INSTALL a
```

```
REMOVE a
```

- uninstall <a>. Now that <b> is no longer needed, remove <b>.

~~~~

```
DEPEND a b
```

```
INSTALL a
```

```
INSTALL b
```

```
REMOVE a
```

- uninstall <a>. <b> is no longer needed for <a>, but was explicitly installed, so we do not remove it.

**LIST**

Takes no arguments. List all currently installed programs

Example:

```
DEPEND a b
INSTALL a
LIST
```

– <a> and <b> are installed. echo each package on a new line.

END

The end of the input is marked by a line containing only the word **END**.

### Output:

Your package manager should first 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 *Expected Output*, below, for examples of all cases). For the **LIST** command, display the names of the currently installed components. No output, except the echo, is produced for a **DEPEND** command or the line containing **END**.

### Sample Input:

```
DEPEND TCPIP NETCARD
DEPEND TELNET TCPIP SOCKET
DEPEND DNS TCPIP
DEPEND HTML REGEX XML
DEPEND REGEX PARSING
DEPEND BROWSER DNS TCPIP HTML CSS
INSTALL TCPIP
REMOVE NETCARD
REMOVE TCPIP
REMOVE NETCARD
INSTALL TCPIP
LIST
INSTALL TCPIP
INSTALL foo
REMOVE TCPIP
INSTALL NETCARD
```

```
INSTALL TCPIP
REMOVE TCPIP
LIST
INSTALL TCPIP
INSTALL NETCARD
REMOVE TCPIP
LIST
REMOVE NETCARD
INSTALL BROWSER
LIST
REMOVE BROWSER
LIST
INSTALL HTML
INSTALL TELNET
REMOVE SOCKET
INSTALL DNS
INSTALL BROWSER
REMOVE NETCARD
LIST
REMOVE BROWSER
LIST
```

### Expected Output:

```
DEPEND TCPIP NETCARD
DEPEND TELNET TCPIP SOCKET
DEPEND DNS TCPIP
DEPEND HTML REGEX XML
DEPEND REGEX PARSING
DEPEND BROWSER DNS TCPIP HTML CSS
INSTALL TCPIP
    Installing NETCARD
```

```
    Installing TCPIP
REMOVE NETCARD
    NETCARD is still needed.
REMOVE TCPIP
    Removing TCPIP
    Removing NETCARD
REMOVE NETCARD
    NETCARD is not installed.
INSTALL TCPIP
    Installing NETCARD
    Installing TCPIP
LIST
    NETCARD
    TCPIP
INSTALL TCPIP
    TCPIP is already installed.
INSTALL foo
    Installing foo
REMOVE TCPIP
    Removing TCPIP
    Removing NETCARD
INSTALL NETCARD
    Installing NETCARD
INSTALL TCPIP
    Installing TCPIP
REMOVE TCPIP
    Removing TCPIP
LIST
    NETCARD
    foo
INSTALL TCPIP
    Installing TCPIP
```

INSTALL NETCARD

NETCARD is already installed.

REMOVE TCPIP

Removing TCPIP

LIST

NETCARD

foo

REMOVE NETCARD

Removing NETCARD

INSTALL BROWSER

Installing CSS

Installing NETCARD

Installing TCPIP

Installing DNS

Installing PARSING

Installing REGEX

Installing XML

Installing HTML

Installing BROWSER

LIST

BROWSER

CSS

DNS

HTML

NETCARD

PARSING

REGEX

TCPIP

XML

foo

REMOVE BROWSER

Removing BROWSER

Removing CSS

Removing DNS

Removing HTML

Removing REGEX

Removing TCPIP

Removing XML

Removing NETCARD

Removing PARSING

LIST

foo

INSTALL HTML

Installing PARSING

Installing REGEX

Installing XML

Installing HTML

INSTALL TELNET

Installing SOCKET

Installing NETCARD

Installing TCPIP

Installing TELNET

REMOVE SOCKET

SOCKET is still needed.

INSTALL DNS

Installing DNS

INSTALL BROWSER

Installing CSS

Installing BROWSER

REMOVE NETCARD

NETCARD is still needed.

LIST

BROWSER

CSS

DNS

HTML

NETCARD

PARSING

REGEX

SOCKET

TCPIP

TELNET

XML

foo

REMOVE BROWSER

Removing BROWSER

Removing CSS

LIST

DNS

HTML

NETCARD

PARSING

REGEX

SOCKET

TCPIP

TELNET

XML

foo