System Programming - Programming Assignment 2

Problem Description:

Do you know the “small world experiment” or the “six degrees of separation” theory? Stanley Milgram and other researchers proved that the **average (shortest) path length** for **social networks** of people in the United States is **6!**

Amazing, isn’t it? Let’s do some experiments to find out the **shortest path length** between two files or directories for **file networks**!

Design Document:

P.S. The “files” mentioned below means normal files, not includes soft link files.

At first, you will get a root pathname: P. (P is not longer than 1024 characters.) And your job is computing the sum of shortest path length between every files or directories pairs under the root P. (The number of files and directories is less than 1000.)

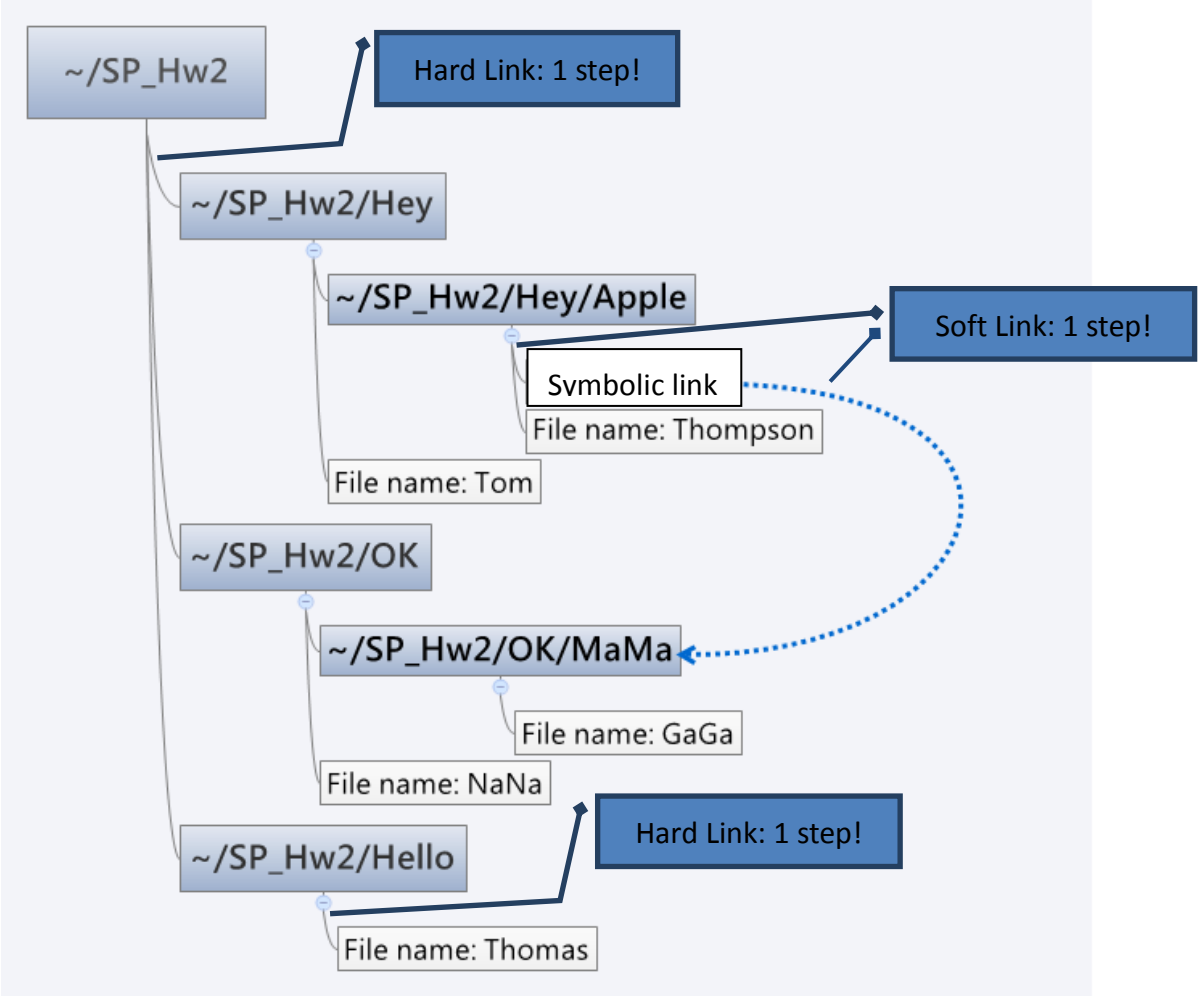
What are the paths between two files or directories?

1. Hard links from a directory to a file
2. Hard links from a directory to another directory
3. A directory with soft link to another file or directory

Every link is **one** step.

Example:

The root P is "~/SP_Hw2":



In this example, the shortest path length between "~/SP_Hw2/Hello/Thomas" and "~/SP_Hw2/OK/MaMa/GaGa" is 5 steps:

1	~/SP_Hw2/Hello/Thomas	->	~/SP_Hw2/Hello
2	~/SP_Hw2/Hello	->	~/SP_Hw2
3	~/SP_Hw2	->	~/SP_Hw2/OK
4	~/SP_Hw2/OK	->	~/SP_Hw2/OK/MaMa
5	~/SP_Hw2/OK/MaMa	->	~/SP_Hw2/OK/MaMa/GaGa

You have to compute the shortest path lengths for each two files or directories (file<->file, file<->directory, directory<->directory) and compute the sum of all numbers.

You may get an option condition (“-s” or “-t”) before pathname P. If your program finds that there is a condition, it should keep following rules:

Condition	Meaning	Example
“-s”	The size of files and directories on any paths shouldn’t be larger than a number. (If there is a file or a directory is larger than the number, then it shouldn’t be a part of any paths)	“-s 500”: The size of files and directories on any paths shouldn’t be larger than 500 bytes.
“-t”	If a file’s (or a directory’s) mtime and ctime aren’t equal, then it can’t be a part of any paths.	

Note 1: If there are no paths between two files or directories, the shortest path length is -1.

Note 2: The directory tree may contain symbolic link. You should trace symbolic links and prevent loops.

Format

Input:

Your executable file should be named hw2 (written in your Makefile). Input will be one pathname P and zero or one conditions from command line. The length of P is not longer than 1024 characters.

The format of command:

% ./hw2 [condition] P

A sample command:

% ./hw2 /nfs/m2/98/r0092xxxx/SP_Hw2
% ./hw2 -s 500 /nfs/m2/98/r0092xxxx/SP_Hw2
% ./hw2 -t /nfs/m2/98/r0092xxxx/SP_Hw2

Output:

The output is the sum of all shortest path length for the pair of files or directories. (Output it to standard output.)

A sample output:

10

Requirements:

- Platform : linux1~10 workstations at CSIE
- Note that you can output any message to STDERR, but you should only output the answer to STDOUT.

Grading:

- 1 point: compile success & test data
- 1 point: hard links only
- 2 point: hard links and soft links
- 3 point: hard links, soft links and a condition

Submission:

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