2006/2007 SOUTHERN CALIFORNIA REGIONAL
ACM INTERNATIONAL COLLEGIATE PROGRAMMING CONTEST

Problem 7
Solar Powered Data Center

BigOh Corporation is expanding into Swamp County by building a new datacenter housing thousands of powerful server computers. Operating a datacenter requires a significant amount of electrical power, which is a particular challenge given Swamp County's poor infrastructure. Given Swamp County's sub-tropical location, one thing the county does have in large amounts is sunshine. BigOh, being an environmentally responsible company, is exploring the possibility of building and operating a completely solar-powered datacenter. Your task is to help estimate the feasibility of such a datacenter under various conditions.

Given a four-day sunlight forecast, information about the solar panels and the servers, and a list of jobs to process, your team is to write a program that will determine if the requested jobs can be completed without running out of power.

The four-day sunlight forecast consists of four input lines with one-day forecasts, each of which consists of a day name, sunrise time, sunset time, and cloud index floating point value between 0.000 and 1.000, separated from each other by whitespace. Times are specified on a 24-hour clock, so, for example, 1:00 PM would be written as 13:00. Day names will be single words of no more than 20 characters.

The solar panels in the solar array are all flat, unobstructed, and aligned to be perpendicular to the sun at noon. On a day with exactly 12 hours of sunlight and a cloud index of 0.000, the solar panel array will collect 100 kilowatt hours (kWh). The amount of power collected scales linearly with the sunshine duration and cloud index. For example, on a day with 15-hours of sunshine and a cloud index of 0.5, the array would generate 62.5 kWh. No power at all is collected before dawn or after sunset.

Power flows from the solar panel arrays to a high-capacity battery system. This battery system has a large capacity, but it is still limited to a given number of output kWh. The battery system also loses a certain percentage of the power put into it. For example, a battery system that has a maximum output capacity of 100 kWh and is 80% efficient would have an output of 100 kWh if and only if the solar panel arrays generated at least 125 kWh that day. The battery system capacity in kWh and efficiency percentage will be specified on one input line after the forecast, separated by whitespace.

To protect the capacity of the batteries over their lifetime, the entire battery system is completely drained just before dawn each day. To minimize overheating, the servers operate only during the cool late-night hours. The servers are fast enough to do all needed work between sunset and midnight, so the time needed to execute each job will not be a limiting factor—only the power consumed matters.

Each processing job is a massively parallel task that all servers work on as a group, and only one job may be active at any moment in time. Each job must run to completion in a single night. Some jobs are independent of other jobs, while others can only be run after some other job has produced needed output. The program input may specify from one to ten jobs. Each job is described by one line with a unique upper-case letter ID, the kWh of power needed to complete the job as a floating point value, the IDs of zero or more prerequisite jobs, and a human-readable string inside quotation marks that describes the purpose of the job. These fields are separated from each other by whitespace.

Your program should determine a four-day job schedule. Your program's output is to be a single line with the job IDs in the order in which the jobs should be run, with the days separated from each other by vertical-bar characters. If there are multiple possible schedules, print the one which is lexigraphically first in ASCII. If there is no possible schedule that will allow all jobs to complete without running out of power, your program should instead print one line: "Insufficent sunlight for requested jobs." If the input specifies dependencies between jobs that contain a cycle or a dependency on a non-existent job, print the line "Invalid job dependencies."

Problem 7
Solar Powered Data Center (continued)

Sample Input

```
Mon 06:02 17:58 0.000
Tue 06:02 17:58 0.000
Wed 06:03 17:57 0.200
Thu 06:03 17:57 0.250
100 80%
A 12.0 "crawl web sites"
B 22.0 A "parse web pages"
C 18.8 "filter out spam emails"
D 45.9 B "build web page index"
E 69.6 B "compute page rank"
F 13.3 "optimize text advertising bids"
G 10.0 "crawl news sites"
H 47.2 "stitch together satellite photos"
I  4.9 B "classify pages for safesearch"
J 18.8 "transcode video clips"
```

Output for the Sample Input

```
ABCIJ|E|DF|GH
```