ES 103
4 Aug 2015
Practice program 1

A taxi fleet consists of diesel and electric cars. For this exercise, we have data about the fuel efficiency and current fuel level of all cars in the fleet. We would like to calculate the range of the car (distance it can cover with the current fuel level). Assume there is a max of 100 cars in the fleet.

For diesel cars, the fuel efficiency of each car is specified in km/l and the amount of fuel remaining in the tank is specified in litres. For electric cars, efficiency is specified in W-h/km and the remaining battery charge is specified as a percentage of the total battery energy currently remaining. Assume all electric cars have a battery capacity of 100 kW-h, and assume the fuel efficiency is a constant for a given vehicle.

The input data is a file with the following information:
Line 1: integer n – the number of cars in the fleet
Lines 2 to n+1 each contain an integer and two float values.
The first integer is 1 or 2 indicating if the car is diesel or electric respectively
The next value, a float, is the fuel efficiency of the current car
The third value, a float is the amount of fuel left in the car (diesel) or percentage charge (electric car), as described above .

Write a C program that reads this data, stores relevant information about each car, and the prints out the range for each car. Essentially, the program should have two loops: one to read information about each car and store the data in an appropriate structure and format, and the second loop should iterate over the set of cars and print out the range of each car. The order of cars in the output should be the same as in the input file.

The output should be a series of lines, each line looking like:
Car i: range = _____

Sample data:
5

1 15.0 11.5
2 172.1 35.5
2 150.5 73
1 14.0 14.0
2 160.5 11

Modify your program to satisfy each of the variations below. Try to complete one variation before reading the next one.

Variation 1:

Assume electric cars can have different batter capacities. So, the input file has an additional value for electric cars. That is, for electric cars, the line of data has 4 values:

<type == 2> <Efficiency (float w-h/l)> <Remaining charge (float % of max capacity)> <Battery size (float kW-h)>

What changes would be required in your code?

New data file

5
1 15.0 11.5
2 172.1 35.5 100
2 150.5 73 125
1 14.0 14.0
2 160.5 11 75

Variation 2:

Assume we have an additional type of car – a hybrid car, that has both a diesel engine and an electric engine, and would therefore carry both diesel fuel and a battery. Each of the engines would have their own efficiencies (assume they work independently and no re-charging happens during travel), and the range would be the sum of the range of each engine. So, the input data would look like:

<type == 3> <diesel efficiency> <diesel fuel left> <battery size> <electric efficiency> <remaining charge %age>

5
1 15.0 11.5
2 172.1 35.5 100
2 150.5 73 125
1 14.0 14.0
3 17.0 5.5 120 175.0 30
2 160.5 11 75

What parts of your code would change to handle this?

Variation 3:

Can you restructure your code and write your main in such a way that there are no changes to the loop that iterates through and prints the range of each car - for the variations we have discussed above?? Changes should be restricted to the "read" part, other parts of the code, or other files.