Gifting Problem

Problem statement:

Suppose you are in charge of a non-profit organization that receives donated gifts and distributes them to needy children. You are given a list of children with their ages (0 to 16 years old).

For each gift, you are given the following information:

Retail price
Size of gift (cubic feet)
Range of suitable ages

Let: P = sum of retail prices of the gifts
N = total number of children
e_i = | P/N – sum of retail prices for gifts given to child i |

You must minimize $\Sigma\ e_i$ for the N children, subject to the following constraints:

1. Each gift must be given to exactly one child.
2. No child may be given a gift that is not intended for their age.
3. Each child must receive at least one large and one medium gift, where 1 ft^3 <= medium gift <= 2 ft^3, and 2 ft^3 < large gift.
4. The number of gifts received by each child can be no less than the average – 1 and no more than the average + 1.

Important:
The sum of the e_i values MUST be the absolute lowest value that is possible for the given input file.

Command line: ./gifting inputFileName outputFileName

Rubric:

Compiles, good programming style, processes command line arguments	15 pts.
Produces correctly formatted output file with all children and gifts included	10 pts.
Produces optimal solution	70 pts.
Compute time/space efficiency, creativity	5 pts. + extra credit possible

Notes:
1. Extra credit could possibly be large
2. Programming style based on Department Standards (see Programming Standards file on Canvas)
3. A signed Academic Integrity statement must be submitted to receive credit

Programs that do not compile and produce an executable on Clark will not be graded
Programs MUST be written in C/C++

Input format:

Plain text tab-delimited file. See example on next page.

Child1	age	8
Child2	age	6
Child3	age	4

Gifts	Price	Size	Ages
G1	12	1.3	7-14
G2	15	2.5	any
G3	8	1.5	0-5
G4	22	2.8	6-16
G5	10	1.5	any
G6	11	2.1	any

Output format:

The output should be a plain text tab-delimited file. It must begin with 'Sum_e_i *x*', where *x* is the sum of the e_i values. This should be followed by *N* rows, one for each child (in order), with their assigned gifts and e_i value as follows:

Sum_e_i 12.0			
Child1	G1	G6	3
Child2	G5	G4	6
Child3	G3	G2	3