Problem A: Corporate Cashier Follies

Consider the following problem that has recently come up at the McCrafty Fast Food Corporation: An efficiency consultant on loan from ENRON has analyzed McCrafty restaurant operations worldwide and noted the following three universal factors when cashiers give customers change from a purchase:

1. Cashiers like to give back as few coins as possible;
2. Customers are willing to accept a lower amount than their actual change if it keeps a cashier happy; and
3. The relative strengths of preferences (1) and (2) vary from season to season and from country to country, *e.g.*, some cashiers are lazier than others and some customers are stingier than others.

Given a set $C = \{c_1, c_2, \ldots, c_n\}$ of n coin-values and the amount amt owed a customer, the consultant has proposed the function

$$f(ret, i_a, i_b) = \begin{cases} (i_a \times minCoins(C, ret)) + (i_b \times (amt - ret)) & \text{if minCoins(C,ret)} > 0 \\ (i_b \times amt) & \text{otherwise} \end{cases}$$

where ret is the amount returned by the cashier, i_a and i_b are cashier and customer irritation factors, respectively, and $minCoins(C, x)$ is the minimum number of coins with values from the set C whose values sum to x (note that $minCoins(C, x) = 0$ if there is no set of coins with values from C whose values sum to x). For example, given $C = \{2, 5, 25\}$ and $amt = 49$,

- $f(45, 1, 1) = (1 \times 5) + (1 \times (49 - 45)) = 9$;
- $f(47, 1, 1) = (1 \times 6) + (1 \times (49 - 47)) = 8$;
- $f(45, 3, 1) = (3 \times 5) + (1 \times (49 - 45)) = 19$; and
- $f(47, 3, 1) = (3 \times 6) + (1 \times (49 - 47)) = 20$.

The consultant conjectures that if the cashier always returns change equal to the value of ret that minimizes $f()$, cashier and customer satisfaction will be optimized and the McCrafty Corporation will also have access to a previously underutilized source of revenue.

Given C, amt, i_a, and i_b, compute a value ret that minimizes function $f()$ specified above. The input will consist of a $(3 \times i)$-line file, $i \geq 1$, such that in each group of 3 lines, line 1 gives the number n of coins in C, line 2 contains the n values of the coins in C sorted in ascending order, and line 3 gives the values of amt, i_a, and i_b, respectively. You may assume that all input files are formatted correctly.

Sample input (available as file "A.in"):

```
3
2 5 25
9 1 1
3
2 5 25
9 2 1
3
2 5 25
9 5 1
3
2 5 25
9 2 2
```

Sample output (available as file "A.out"):

```
    Amount returned on 9 cents is 9 cents [3 coin(s) / F-val = 3]
    Amount returned on 9 cents is 5 cents [1 coin(s) / F-val = 6]
    Amount returned on 9 cents is 0 cents [0 coin(s) / F-val = 9]
    Amount returned on 9 cents is 9 cents [3 coin(s) / F-val = 6]
```