Accessory Collection

HackerRank

Victoria is splurging on expensive accessories at her favorite stores. Each store stocks A types of accessories, where the i^{th} accessory costs i dollars ($1 \leq i \leq A$). Assume that an item's type identifier is the same as its cost, and the store has an unlimited supply of each accessory.

Victoria wants to purchase a total of L accessories according to the following rule:

Any N-element subset of the purchased items must contain *at least* D different types of accessories.

For example, if $L = 6$, $N = 3$, and $D = 2$, then she must choose 6 accessories such that *any* subset of 3 of the 6 accessories will contain *at least* 2 distinct types of items.

Given L, A, N, and D values for T shopping trips, find and print the maximum amount of money that Victoria can spend during each trip; if it's not possible for Victoria to make a purchase during a certain trip, print `SAD` instead. You must print your answer for each trip on a new line.

Input Format

The first line contains an integer, T, denoting the number of shopping trips.
Each of the T subsequent lines describes a single shopping trip as four space-separated integers corresponding to L, A, N, and D, respectively.

Constraints

- $1 \leq T \leq 10^6$
- $1 \leq D \leq N \leq L \leq 10^5$
- $1 \leq A \leq 10^9$
- The sum of the L's for all T shopping trips $\leq 8 \cdot 10^6$.

Output Format

For each shopping trip, print a single line containing either the maximum amount of money Victoria can spend; if there is no collection of items satisfying her shopping rule for the trip's L, A, N, and D values, print `SAD` instead.

Sample Input

```
2
6 5 3 2
2 1 2 2
```

Sample Output

```
24
SAD
```

Explanation

Shopping Trip 1:
We know that:

- Victoria wants to buy $L = 6$ accessories.
- The store stocks the following $A = 5$ types of accessories: $\{1, 2, 3, 4, 5\}$.
- For any grouping of $N = 3$ of her L accessories, there must be *at least* $D = 2$ distinct types of accessories.

Victoria can satisfy her shopping rule and spend the maximum amount of money by purchasing the following set of accessories: $\{3, 4, 5, 5, 4, 3\}$. The total cost is $3 + 4 + 5 + 5 + 4 + 3 = 24$, so we print 24 on a new line.

Shopping Trip 2:
We know that:

- Victoria wants to buy $L = 2$ accessories.
- The store stocks $A = 1$ type of accessory: $\{1\}$.
- For any grouping of $N = 2$ of her L accessories, there must be *at least* $D = 2$ distinct types of accessories.

Because the store only carries 1 type of accessory, Victoria cannot make a purchase satisfying the constraint that there be at least $D = 2$ distinct types of accessories. Because Victoria will not purchase anything, we print that she is `SAD` on a new line.