DATA STRUCTURES AND ALGORITHMS

Questions from A7 and A8
Language allowed: C

June 11, 2020

General Instructions

1. The following part of the document contains **two questions**, one from A7 and other from A8.

2. **Three testcases** for each problem are included at the end of the problem statement. You are expected to submit the output of your programs (for each testcase) along with their respective codes in **a single PDF file**.

3. You need to paste the the screenshots of the output of your program for all three testcases for each problem in your submission along the code for the problem (Hint: The best way would be to paste everything in a single word doc and export it as a PDF). Make sure to label each testcase and problem neatly so as to avoid any discrepancy during evaluation. Also, please adhere to the output format mentioned in the problem statement and do not print any extraneous output.

4. Please refrain from copying and submitting others code as all codes will be run through a plagiarism check and any sort of dishonesty will be viewed seriously. Make sure that the output of your code and the output you have documented are one and the same. Any sort of difference will lead to reduction of marks.

5. Rename your submission as DSA_A7_A8_<your_id>.pdf

6. You need to submit this PDF file in CMS in **your respective lab section only**. Please do not mail your submission to the instructors or submit in another lab section.

7. Deadline for submission: **18/6/2020, 17:00**. Please note that this is a hard deadline and no extensions will be provided.

Problem-1. Chocolates

Upon his return from the States, your father has brought you a lot of chocolates. On the first day, he arranges N bowls and adds a few chocolates to each bowl. Everyday (starting from day one), you decide to eat the chocolates from the bowls and select one bowl at random and eat X chocolates from it. The next day, your dad replenishes the bowl (from which you ate the chocolates) with $\lfloor X/3 \rfloor$ chocolates. You now start thinking about the *maximum* number of chocolates you can eat in a span of few days and decide to write a simple program that will calculate the same for you.

Input

The first line of input contains two space-separated integers N ($1 \leq N \leq 10^5$) and D ($1 \leq D \leq 10^5$) denoting the number of bowls and the number of days for which you want to make the calculation respectively. The following line contains N space-separated integers ($0 \leq A_i \leq 10^9$) denoting the number of chocolates put in each of bowls (the i^{th} integer denotes the number of chocolates put in the i^{th} bowl). Assume the bowls are numbered serially from 1 onwards.

Output

Print a single integer X, denoting the *maximum* number of chocolates you can eat by the end of D days. As the number can be large, print it to modulo ($10^9 + 7$).

```
input
5 7
4 16 6 27 8

output
75
```

Testcases for evaluation (Problem-1):

Testcase-1

```
input
13 12
42 44 44 11 56 28 73 69 82 11 14 44 36
```

Testcase-2

```
input
10 10
101 112 96 5 78 12 8 128 120 100
```

Testcase-3

```
input
7 12
2 2 2 2 2 2 2
```

Problem-2. Okabe and the Graph of Worldlines

After more months of research, Okabe Rintarou had yet another epiphany. This time he realized that the worldlines can be visualized as vertices in a graph and the the transitions between those worldlines can be seen as edges. Each transition (between some pair of worldlines) requires a set amount of energy. Okabe can transit between those worldlines only if he overcomes that *transition potential*. To complete his experiment, Okabe needs to know the minimum of all *total transition potentials* of all *spanning sub-graphs* possible in this graph of worldlines. As Okabe is has promised to take Suzuha and Daru out for dinner today, it's up to you, Makise Kurisu, to figure it out. *Total transition potential of a sub-graph* is defined as the sum of all transition potentials in that sub-graph. Assume the transitions to be undirected. A spanning sub-graph is a graph connecting all vertices.

Input

The first line contains two space-separated integers N ($2 \leq$ N $\leq 5.10^3$) and M ($1 \leq$ M $\leq \frac{N(N-1)}{2}$) denoting the number of worldlines and the number of transitions respectively. The following M lines contain three space-separated integers U_i, V_i ($0 \leq U_i$, $V_i \leq$ N-1) and W_i ($0 \leq W_i \leq 10^9$), with W_i denoting the transition potential of the transition between worldlines U_i and V_i. Note that, transitions may not exist between every pair of worldlines. It is guaranteed that the given graph of worldlines will be connected and there won't be multiple disconnected components.

Output

Print a single integer X, denoting the minimum of all *total transition potentials* of all sub-graphs possible in this graph of worldlines.

```
input
7 11
0 1 5
1 4 3
4 6 1
6 5 3
5 2 5
2 0 7
2 3 5
3 6 3
3 4 4
0 4 2
1 5 2

output
16
```

Testcases for evaluation (Problem-2):

Testcase-1

```
input
7 12
0 2 1
0 4 3
0 5 1
1 4 3
1 5 1
2 3 2
2 4 3
4 5 3
3 4 3
1 6 2
6 3 2
6 4 3
```

Testcase-2

```
input
8 11
0 1 1
1 2 3
2 3 5
3 7 4
7 6 4
6 2 2
1 5 7
0 4 1
4 1 2
1 6 5
4 7 3
```

Testcase-3

```
input
6 10
0 2 3
0 4 3
0 5 5
1 4 1
1 5 3
2 3 2
2 4 1
4 5 1
2 5 4
3 0 2
```