International Institute of Information Technology, Bangalore
CSE 102P Data Structures and Algorithms Lab- Sec A
End Term Exam: 12 May 2026.

You are given a **directed graph** with n nodes (numbered 0 to $n-1$) and m edges. Each node i has a weight $w[i]$.

For a node v and distance k, define:

$M_k(v)$ = the **maximum weight** among all nodes that are reachable from v via a directed path of length **at most** k edges.

Note: Distance is measured in terms of **number of edges**. The node v itself is at distance 0, so v is always reachable within distance k.

Your task: Given n, m, k, the weights, and the edges, compute:

$$\text{Sum} = \sum_{v=0}^{n-1} M_k(v)$$

That is, for each node v, find the maximum weight among all nodes reachable within **at most** k hops, and return the **sum** of these values over all nodes.

Input Format

```
n m k
w[0] w[1] ... w[n-1]
u1 v1
u2 v2
...
um vm
```

First line: Three integers n, m, k

- $1 \leq n \leq 10^4$
- $0 \leq m \leq 10^4$
- $0 \leq k \leq n$

Second line: n integers $w[0], w[1], \ldots, w[n-1]$

- $0 \leq w[i] \leq 10^9$

Next m **lines:** Each contains two integers u v representing a directed edge from u to v

- $0 \leq u, v < n$

Output Format

Print a single integer: $\sum_{v=0}^{n-1} M_k(v)$

Constraints

- $1 \leq n \leq 10^4$
- $0 \leq m \leq 10^4$
- $0 \leq k \leq n$
- $n \times m \leq 10^8$
- $0 \leq w[i] \leq 10^9$
- Graph may contain cycles
- Graph may be disconnected
- No multiple edges in the same direction

Sample 1

Input:

```
4 4 2
5 3 8 2
0 1
1 2
2 3
0 2
```

Output: 26
Explanation:
Graph structure: $0 \to 1$, $0 \to 2$, $1 \to 2$, $2 \to 3$

For $k = 2$ (nodes within at most 2 edges):

Node	Reachable Nodes (distance)	Weights	Max
0	0 (d=0), 1 (d=1), 2 (d=1), 2 (d=2 via 0→1→2), 3 (d=2)	$\{5, 3, 8, 2\}$	8
1	1 (d=0), 2 (d=1), 3 (d=2)	$\{3, 8, 2\}$	8
2	2 (d=0), 3 (d=1)	$\{8, 2\}$	8
3	3 (d=0)	$\{2\}$	2

Sum = $8 + 8 + 8 + 2 =$ **26**

Sample 2

Input:

```
5 5 2
10 20 15 30 25
0 1
```

```
1 2
2 3
3 4
4 0
```

Output: 135
Explanation:
Graph is a cycle: $0 \to 1 \to 2 \to 3 \to 4 \to 0$

For $k = 2$ (nodes within at most 2 edges):

Node	Reachable Nodes	Max
0	$\{0, 1, 2\}$	$\max(10, 20, 15) = 20$
1	$\{1, 2, 3\}$	$\max(20, 15, 30) = 30$
2	$\{2, 3, 4\}$	$\max(15, 30, 25) = 30$
3	$\{3, 4, 0\}$	$\max(30, 25, 10) = 30$
4	$\{4, 0, 1\}$	$\max(25, 10, 20) = 25$

Sum $= 20 + 30 + 30 + 30 + 25 =$ **135**

Sample 3

Input:

```
6 7 3
7 4 9 2 8 5
0 1
1 2
2 3
3 4
4 5
0 3
1 4
```

Output: 48
Explanation:
Graph: $0 \to 1 \to 2 \to 3 \to 4 \to 5$ with shortcuts $0 \to 3$, $1 \to 4$

Node	Reachable within 3 hops	M_3
0	0(d=0), 1(d=1), 3(d=1), 2(d=2), 4(d=2), 3(d=3), 4(d=3)	9
1	1(d=0), 2(d=1), 4(d=1), 3(d=2), 5(d=2), 4(d=3)	9
2	2(d=0), 3(d=1), 4(d=2), 5(d=3)	9
3	3(d=0), 4(d=1), 5(d=2)	8
4	4(d=0), 5(d=1)	8
5	5(d=0)	5

Sum $= 9 + 9 + 9 + 8 + 8 + 5 =$ **48**