

Lab5 Questions

YAO ZHAO

Lab5.A: LRU Cache

- ▶ Design a data structure that follows the constraints of a **Least Recently Used (LRU)** cache.
- ▶ Implement a LRU Cache with capacity N .
- ▶ There are M operations including two type:
 - ▶ **get key** : Print the value of the key if the key exists, otherwise print **-1**.
 - ▶ **put key value** : Update the value of the key if the key exists. Otherwise, add the key-value pair to the cache. If the number of keys exceeds the capacity from this operation, evict the least recently used key.
- ▶ The operations get and put must each run in $O(1)$ average time complexity.
- ▶ **Please do not use LinkedHashMap in java.**

Sample Input

2 9
put 1 1
put 2 2
get 1
put 3 3
get 2
put 4 4
get 1
get 3
get 4

Initial:



put 1 1:



put 2 2:



get 1 :



put 3 3:



get 2:



put 4 4:



get 1 :



get 3 :



get 4 :



evicted



Sample Output

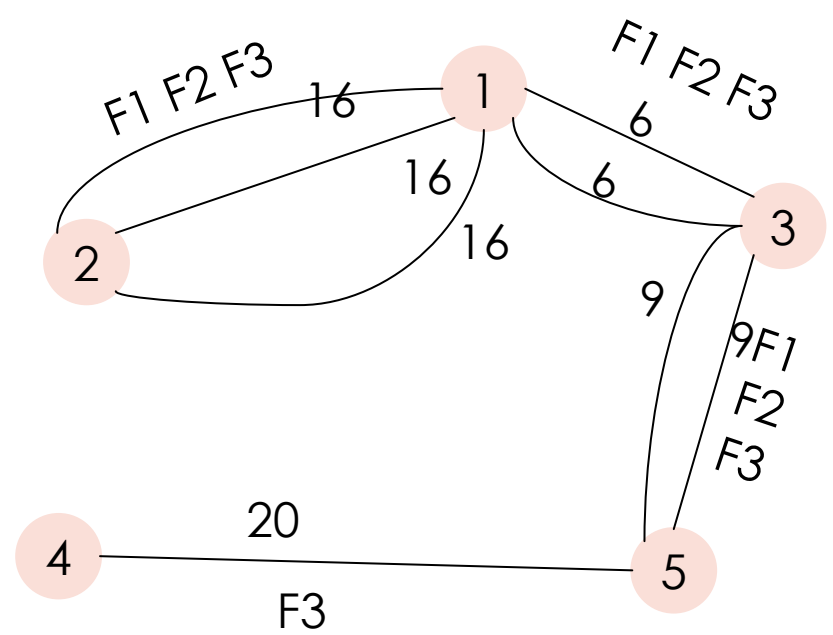
1
-1
-1
3
4

Lab5.B: CHAO MAN

- ▶ One day **CHAO MAN** decides to do an experiment. He takes his P followers to a maze. The maze is a connected, undirected, and weighted graph with N nodes and M edges, where the i^{th} follower of **CHAO MAN** is initially at node s_i and wants to reach node t_i .
- ▶ Then **CHAO MAN** orders: "RUN!" And all his followers rush to their destination just like arrows off the string. As **CHAO MAN**'s fans, they are also super smart, so each of them would definitely choose the shortest route. If there are multiple shortest route for a fan, he or she can choose anyone of them.
- ▶ Now **CHAO MAN** wants to know, for each edge, how many people would visit it at most for all possible situations?

Sample Input

5 8
3 5 9
4 5 20
1 3 6
2 1 16
2 1 16
3 5 9
2 1 16
1 3 6
3
5 2
5 2
2 4



F1: 5 → 2: 5 > 3 > 1 > 2
F2: 5 → 2: 5 > 3 > 1 > 2
F3: 2 → 4: 4 > 5 > 3 > 1 > 2

Edge	Follows	number
E1:3 5 9	F1, F2, F3	3
E2:4 5 20	F3	1
E3:1 3 6	F1, F2, F3	3
E4:2 1 16	F1, F2, F3	3
E5:2 1 16	F1, F2, F3	3
E6:3 5 9	F1, F2, F3	3
E7:2 1 16	F1, F2, F3	3
E8:1 3 6	F1, F2, F3	3