FAKULTAS ILMU KOMPUTER

CSGE602040 - Struktur Data dan Algoritma
Semester Genap - 2021/2022
TP 2
Deadline: Tuesday, 19 April 2022, 23.55 WIB

Package Delivery

Description

Nowadays, Izuri works as a deliveryman in the country of Ilkomnesia. There are P islands in Ilkomnesia, which are numbered from 1 to P. Uniquely, those islands form a *Binary Tree* where island number 1 is the root, and there are a number of highways that function as a bridge between those islands. Each highway has the same length of 1 unit. Izuri works at the distribution warehouse that is located at the *root* (island number 1) by delivering the package from island to island by going through those highways.

Initially, the distribution warehouse is empty and is only filled with packages after there is a customer that orders. The package will be removed from the warehouse if a customer asks to delete it, or an admin asks Izuri to deliver the package to its destination island. Every package i has a name N_i, a priority code C_i, and destination island T_i. To ease the process of delivery, all packages that go in will be stored in order of priority code (C_i) from the smallest in the front to the largest in the back. If there are packages with the same priority code, then the packages ordered first will be placed in front of the packages ordered after it.

The customer can do actions with the following format:

- **1** $N_i\ C_i\ T_i$: Customer **creates** an order of a package named N_i, with priority code C_i, and delivering to island number T_i. it is important to note that the ordered package will be stored and sorted in the distribution warehouse.
- **2** N_i : Customer **deletes** the order of a package named N_i. The deleted package will be removed from the distribution warehouse. Be wary of customers being negligent, there is a possibility that a package named N_i does not exist in the warehouse whether it was because it has been delivered or that it has not been ordered.

Other than that, the admin of the warehouse can do actions with the following format:

- **3** B_i : Admin asks Izuri to **deliver** B_i amount of packages from the front of the package order in the distribution warehouse. To save time, Izuri will deliver B_i amount of packages following this order:
    a. Packages will be delivered in order starting from the package with the **shortest distance** between island 1 and its destination island.
    b. If there are packages with the same distance, packages with the **smallest island number** will be prioritized.
    c. If there are packages with the same distance and destination island, the packages will be delivered in order of the **packages name alphabetically.**

Input Format

- The first line consists of integer P which represents the number of islands.
- The next P lines consists of 2 integers L_i and R_i which represents the left child (L_i) and the right child (R_i) of island number i. If the island does not have a left child, then L_i will be 0. If the island does not have a right child, then R_i will be 0.
- The next line consists of integer Q which represents the amount of queries.
- The next Q lines consist of actions which can be done by customers (action **1** or **2**), or by admins (action **3**).

Output Format

For each action done, output:

- **2** : prints "BERHASIL" if the deletion is successful; prints "GAGAL" if the package is not found.
- **3** : prints B_i amount of lines, each consisting of the package name delivered by Izuri, in delivery order.

Range

- $2 \leq P, Q \leq 10.000$
- $2 \leq L_i \leq P$ atau $L_i = 0$
- $2 \leq R_i \leq P$ atau $R_i = 0$
- $1 \leq$ length(N_i) ≤ 5, and N_i is unique and only consists of capital letters ($A - Z$)
- $2 \leq T_i \leq P$
- $1 \leq C_i, B_i \leq 10.000$

Input Example 1

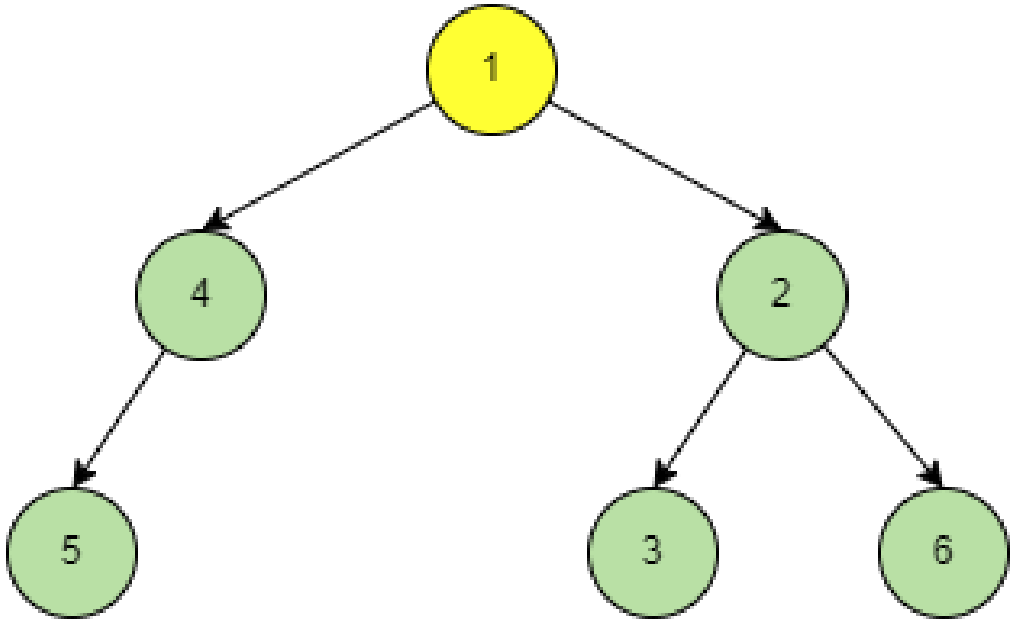
```
6
4 2
3 6
0 0
5 0
0 0
0 0
7
1 TOPI 3 3
1 KAIN 8 2
1 RODA 4 4
1 GELAS 3 4
2 RODA
1 JAS 8 6
3 3
```

Output Example 1

```
BERHASIL
KAIN
GELAS
TOPI
```

Output 1 Explanation

The country of Ilkomnesia will be in *binary tree* form as follows:



The distribution warehouse at initialization:

PACKAGE NAME	—
PRIORITY CODE	—
DESTINATION ISLAND	—

There are a total of 7 actions done:

- A customer creates a package order named TOPI. State of the distribution warehouse:

PACKAGE NAME	TOPI
PRIORITY CODE	3
DESTINATION ISLAND	3

- A customer creates a package order named KAIN. State of the distribution warehouse:

PACKAGE NAME	TOPI	KAIN
PRIORITY CODE	3	8
DESTINATION ISLAND	3	2

- A customer creates a package order named RODA. State of the distribution warehouse:

PACKAGE NAME	TOPI	RODA	KAIN
PRIORITY CODE	3	4	8
DESTINATION ISLAND	3	4	2

- A customer creates a package order named GELAS. State of the distribution warehouse:

PACKAGE NAME	TOPI	GELAS	RODA	KAIN
PRIORITY CODE	3	3	4	8
DESTINATION ISLAND	3	4	4	2

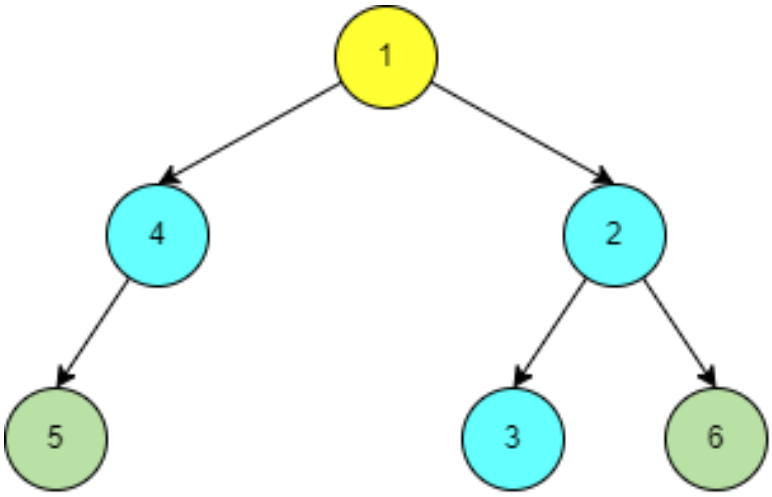
- A customer deletes a package named RODA. Because there exists a package named RODA at the distribution warehouse, it outputs “BERHASIL”. State of the distribution warehouse:

PACKAGE NAME	TOPI	GELAS	KAIN
PRIORITY CODE	3	3	8
DESTINATION ISLAND	3	4	2

- A customer creates a package order named JAS. State of the distribution warehouse:

PACKAGE NAME	TOPI	GELAS	KAIN	JAS
PRIORITY CODE	3	3	8	8
DESTINATION ISLAND	3	4	2	6

- Admin asks Izuri to deliver the 3 front-most packages, which are TOPI, GELAS, and KAIN.



The distance to deliver TOPI to island number 3 is 2 units. The distance to deliver GELAS to island number 4 is 1 unit. The distance to deliver KAIN to island number 2 is 1 unit. The distance to deliver GELAS and KAIN is equal, but the destination number of KAIN’s destination island is smaller so it is prioritized. Izuri will deliver the packages in the order of KAIN, GELAS, and then TOPI.

Input Example 2

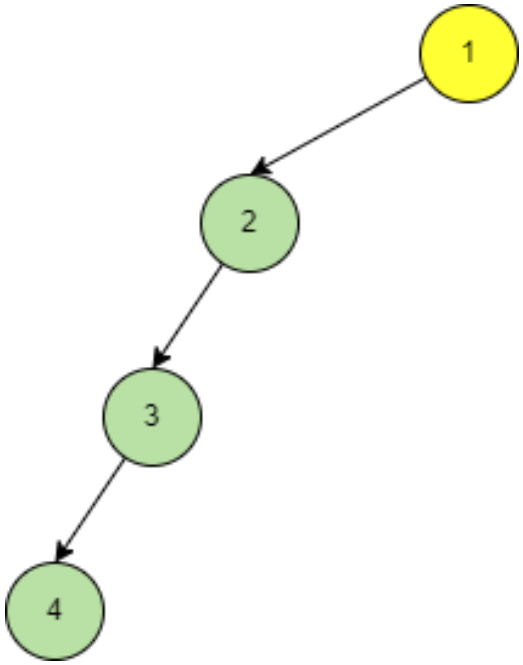
```
4
2 0
3 0
4 0
0 0
7
1 BUKU 1 4
1 BAJU 1 2
1 TISU 3 4
2 POHON
3 10
1 POHON 2 3
3 10
```

Output Example 2

```
GAGAL
BAJU
BUKU
TISU
POHON
```

Example 2 explanation

The country of Ilkomnesia will be in *binary tree* form as follows:



The distribution warehouse at initialization:

PACKAGE NAME	—
PRIORITY CODE	—
DESTINATION ISLAND	—

There are a total of 7 actions done:

- A customer creates a package order named BUKU. State of the distribution warehouse:

PACKAGE NAME	BUKU
PRIORITY CODE	1
DESTINATION ISLAND	4

- A customer creates a package order named BAJU. State of the distribution warehouse:

PACKAGE NAME	BUKU	BAJU
PRIORITY CODE	1	1
DESTINATION ISLAND	4	2

- A customer creates a package order named TISU. State of the distribution warehouse:

PACKAGE NAME	BUKU	BAJU	TISU
PRIORITY CODE	1	1	3
DESTINATION ISLAND	4	2	4

- A customer deletes a package named POHON. Because a package named POHON does not exist in the distribution warehouse, it outputs “GAGAL”. State of the distribution warehouse:

PACKAGE NAME	BUKU	BAJU	TISU
PRIORITY CODE	1	1	3
DESTINATION ISLAND	4	2	4

- Admin then asks Izuri to deliver 10 packages from the warehouse. However, there are only 3 packages in the warehouse, which means Izuri only delivers 3 packages from the warehouse, which are BUKU, BAJU, and TISU. From those three packages, Izuri will deliver the item with the shortest destination distance from the warehouse. The first item that will be delivered is **BAJU** with the shortest distance from island 1. The next two packages have the same destination and distance, which means the packages will be delivered alphabetically, which is **BUKU** and then **TISU**.

  State of the distribution warehouse:

PACKAGE NAME	—
PRIORITY CODE	—
DESTINATION ISLAND	—

- A customer creates a package order named POHON. State of the distribution warehouse:

PACKAGE NAME	POHON
PRIORITY CODE	2
DESTINATION ISLAND	3

- Admin then asks Izuri again to deliver 10 packages. And there is only 1 item that Izuri can deliver, which is **POHON**.

Extra Details

- It is permitted to use the materials that were used in previous lab/TP.

Informasi Tambahan Test-case

Test case number	**Additional Boundaries**
1 - 5	$P,\ Q \leq 100$ C_i unique No type 3 queries
6 - 10	$P,\ Q \leq 100$ No type 3 queries
11 - 15	$P,\ Q \leq 100$ C_i unique $B_i = 1$

	No type 2 queries
16 - 20	$P,\ Q \leq 100$ $B_i = 1$ No type 2 queries
21 - 25	$P,\ Q \leq 100$ C_i unique $B_i = 1$
26 - 30	$P,\ Q \leq 100$ $B_i = 1$
31 - 40	$P,\ Q \leq 100$ C_i unique
41 - 50	$P,\ Q \leq 100$
51 - 55	C_i unique No type 3 queries
56 - 60	No type 3 queries
61 - 65	C_i unique $B_i = 1$ No type 2 queries
66 - 70	$B_i = 1$ No type 2 queries
71 - 75	C_i unique $B_i = 1$
76 - 80	$B_i = 1$
81 - 90	C_i unique
91 - 100	No additional bounds