Problem A. Al-Quds: A City of Ancient Heritage

Input file:	standard input
Output file:	standard output
Balloon Color:	Light Blue

Al-Quds, or Jerusalem, is one of the world's oldest cities, sacred to Islam, Christianity, and Judaism. It features iconic landmarks such as the Dome of the Rock, Al-Aqsa Mosque, the Western Wall, and the Church of the Holy Sepulchre. The UNESCO-listed Old City, with its vibrant markets and ancient sites, reflects a rich cultural heritage shaped by diverse civilizations, making Al-Quds a timeless center of faith and history.

You're given an array a of n integers and q queries. Each query consists of two operations:

1. **Update operation:** r, k — Change the value at index r to k.
2. **Query operation:** l, r — Calculate the value of $P(l, r)$.

Define $P(l, r)$ as the number of subsequences of length $r - l + 1$ in a where every number from l to r (inclusive) appears exactly once.

Since this count can be large, compute it modulo $10^9 + 7$.

Input

The first line contains a single integer t ($1 \le t \le 10^4$) — number of testcases.

For each test case:

The first line contains two integers n and q ($1 \le n, q \le 10^5$), the number of integers in the array and the number of queries, respectively.

The second line contains n space separated integers $a_1, a_2, \ldots, a_n$ ($1 \le a_i \le 10^9$), representing the elements of the array.

Each of the next q lines contains a query. For each query:

— If it is an update operation, the line contains three integers 1, r and k ($1 \le r \le n, 1 \le k \le 10^9$), representing the index to update and the new value.

— If it is a query operation, the line contains three integers 2, l and r ($1 \le l \le r \le 10^9$), representing the range for the query.

Output

For each query operation, output a single integer on a new line, representing the value of $P(l, r)$ modulo $10^9 + 7$.

Example

standard input	standard output
1 6 7 1 1 2 2 3 3 2 1 3 2 1 2 2 2 3 1 1 3 2 1 3 2 1 2 2 2 3	8 4 4 6 2 6

Problem B. Bethlehem: Birthplace of Jesus

Input file:	standard input
Output file:	standard output
Balloon Color:	Bronze

Bethlehem, located in the West Bank of Palestine, is celebrated as the birthplace of Jesus Christ and holds significant religious importance for Christians worldwide. Home to the Church of the Nativity, a UNESCO World Heritage site, Bethlehem's history spans thousands of years. Beyond its religious significance, the city boasts a rich tradition of Palestinian art, music, handicrafts, picturesque landscapes, and olive groves, attracting pilgrims and tourists alike.

Hamoya wants to challenge his students with difficult tasks because he loves them.

The task is as follows:

Given an array of N integers, you are asked to answer Q queries with two types:

1. You are given three intergers L R X. Update the array such that $a_i := a_i + x$ for each $i (L \leq i \leq R)$
2. You are given two integers L R. Calculate $\sum_{i=L}^{R} a_i^3$

Note: Since the answer can be large, you should print the result modulo $10^9 + 7$.

Input

In the first line of input, two integers N $(1 \leq N \leq 10^5)$

In the second line of the input, you will be given n integers, a_i $(1 \leq a_i \leq 10^5)$

In the third line of the input, you will be given Q number of queries: $(1 \leq Q \leq 10^5)$

Following that, there are Q lines with the format 1 L R X or 2 L R $(1 \leq L \leq R \leq N)$

Output

print the answer for every query of type 2 on a single line.

Examples

standard input	standard output
7 2 3 11 9 8 4 3 4 2 2 3 1 2 7 1 2 2 3 2 2 7	1358 1792 3710
5 40591 3097 73574 34426 52281 6 2 4 4 2 1 5 2 1 2 1 3 3 39973 2 5 5 2 3 4	955575183 270524667 624270388 811103748 469845835

Problem C. Cana'an: A Historic Village in Palestine

Input file:	standard input
Output file:	standard output
Balloon Color:	Black

Cana'an, or Khan Yunis, is a historic village in the southern Gaza Strip of Palestine with a rich cultural heritage. Known for its traditional architecture, ancient buildings, and mosques, Cana'an has long been a center of agricultural activity and trade. Despite challenges, the village preserves its cultural identity and traditions, symbolizing resilience and heritage in Palestine.

Hamoya melted and mixed A grams of gold and B grams of silver $(0 \leq A, B, 0 < A + B)$ to produce a new metal.

What metal did he produce: pure gold, pure silver, or an alloy?

Formally, the product is called as follows.

- Pure gold, if $0 < A$ and $B = 0$.
- Pure silver, if $A = 0$ and $0 < B$.
- An alloy, if $0 < A$ and $0 < B$.

Input

The only line of input contains two integers A, B $(0 \leq A, B \leq 100)$ and $A + B \geq 0$.

Output

If the product is pure gold, print **Gold; if it is pure silver, print Silver; if it is an alloy, print Alloy.**

Examples

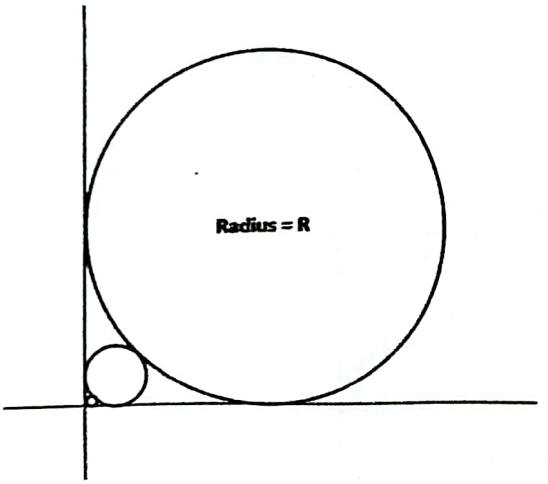
standard input	standard output
0 19	Silver
38 0	Gold
2 7	Alloy

Problem D. Dar al-Hawa: Historic Neighborhood in Jerusalem

Input file:	standard input
Output file:	standard output
Balloon Color:	Purple

Dar al-Hawa, in Jerusalem, is a historic neighborhood known for its ancient architecture and cultural significance, with its name meaning "House of the Wind"in Arabic. Characterized by traditional stone houses, narrow alleyways, and historic landmarks, it reflects Jerusalem's rich heritage and diverse cultural influences. Home to various religious and cultural sites, Dar al-Hawa showcases the coexistence of different communities and attracts visitors with its serene atmosphere and picturesque streets, making it a vibrant cultural treasure in Jerusalem.

We have an infinite number of circles that are tangent to both the positive x axis and the positive y axis. Each circle is also tangent to the previous one, as shown in the picture below.



Example of 3 tangent circles.

Given the radius R of some circle, find the radius of the n_{th} tangent circle towards the origin.

To explain further, if we consider the largest circle with radius R in the previous image, the first tangent circle will be the medium-sized one, and the second tangent circle will be the small-sized one, and so on.

Input

The input consists of multiple test cases. The first line contains a single integer t ($1 \leq t \leq 10^5$).

Each test case contains two integers R and n ($1 \leq R, n \leq 10^9$) The Radius of largest circle and n denotes the n_{th} circle for which we need to determine the radius.

Output

For each test case print the radius of the n_{th} circle. Your answer will be considered correct if its absolute or relative error does not exceed 10^{-6}. Formally let your answer be a, jury answer be b. Your answer will be considered correct if $\frac{|a-b|}{max(1,|b|)} \leq 10^{-6}$.

Example

standard input	standard output
1 5 1	0.85786438

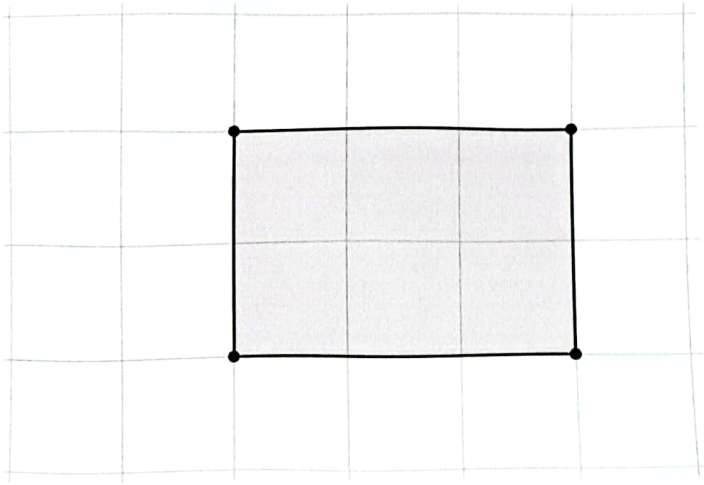
Problem E. Ein Gedi: Oasis of Natural Beauty

Input file:	standard input
Output file:	standard output
Balloon Color:	Red

Ein Gedi, an oasis on the western shore of the Dead Sea in the Judean Desert of Palestine, is renowned for its stunning natural beauty and lush vegetation. Characterized by freshwater springs, waterfalls, and diverse wildlife, its name means "Spring of the Goat"in Hebrew. Historically a place of refuge and inspiration, Ein Gedi is mentioned in biblical texts and has attracted visitors for millennia.

You are given a grid with n rows and m columns representing an ASCII art picture of a rectangle, The grid consists of the following characters:

- "." represents an empty square.
- "|" represents a cell with a segment running from top to bottom.
- "-" represents a cell with a segment running from right to left.
- "+" represents a rectangle corner.



A picture of the first test case.

Find the area enclosed by this rectangle.

The area of this rectangle is equal to the number of empty squares (represented by '.') inside it.

Input

The first line of input contains two integers n and m ($1 \le n, m \le 10^6$) — the number of rows and columns, respectively.

This is followed by n lines, each containing m characters representing the ASCII art picture.

It is guaranteed that the sum of $n \cdot m$ over all test cases does not exceed 10^6.

It is guaranteed that the picture contains exactly one rectangle with a positive area.

Output

the answer required above

Examples

standard input	standard output
6 8 ....+---+. ..|...|. ..|...|. ..+---+.	6
5 6 +----+ |....| |....| |....| +----+	12

Problem F. Far'un: Ancient Village in Palestine

Input file:	standard input
Output file:	standard output
Balloon Color:	Blue

Far'un, near Tulkarm in the northern West Bank of Palestine, is an ancient village rich in history and cultural significance. Known for its traditional Palestinian architecture and agricultural heritage, Far'un has been continuously inhabited for centuries, with roots tracing back to the Canaanite and Roman periods. The village is surrounded by fertile lands with thriving olive groves and citrus orchards, central to its economy and community life.

Hamoya is encountering a difficult problem and he is seeking your assistance.

The problem can be described as follows:

Given an array of n integers and integer k, you need to determine whether the $k-th$ root of the product of all the elements in the array is an integer or not.

In other words, you need to evaluate the following expression:

$$\sqrt[k]{\prod_{i=1}^{n}(a_i)}$$

and check whether it is an integer or not.

Input

The first line contains n and k – $(1 \leq n \leq 10^5)$, $(2 \leq k \leq 50)$ – size of the array and the root.

The second line contains n integers – $(1 \leq a_i \leq 10^5)$.

Output

Output "**YES**" if it's integer and "**NO**" otherwise.

Examples

standard input	standard output
4 4 2 6 12 9	YES
2 2 4 3	NO

Problem G. Gaza City: A Hub of History and Resilience

Input file:	standard input
Output file:	standard output
Balloon Color:	Orange

Gaza City, located in the Gaza Strip of Palestine, is a vibrant urban center with a rich history spanning thousands of years. Known for its strategic Mediterranean location, Gaza has been a hub of trade, culture, and civilization since ancient times. The city boasts historical landmarks such as ancient mosques, churches, and remnants of old civilizations, with its old city walls and narrow alleyways reflecting diverse cultural influences. Despite modern challenges of political unrest and conflict, Gaza City's resilient population preserves its cultural heritage and traditions.

Hamoya is very weak in counting, so he wants you to help him solve this problem or he will die.

He has n buckets, each of them has m balls of the same color, and the balls in different buckets will have a different color.

Hamoya will take a random ball from a random bucket and put it in a line. He will do this operation k times. What are the different ways to do this?

i.e. Count how many different lines Hamoya will have after putting k balls beside each other.

Note: Hamoya can take a ball from the same bucket again as long as this bucket is not empty.

But Hamoya is not this kind of man. He will do this thing q times, and each time he will pick k_i balls and wants you to count the different combinations for him. The queries are independent; they don't affect each other.

Since the answer may be too large, print it modulo 998244353.

Input

The first line contains two integers n, m ($1 \le n \le 10^4, 1 \le m \le 100$) — the number of buckets and the number of balls in each bucket.

The second line contains a single integer q ($1 \le q \le 10^6$).

The third line contains q integers $k_1, k_2, ..., k_q$ ($1 \le k_i \le n * m$) — where k_i is the number of balls Hamoya will pick in the i_{th} time.

Output

Print q integers separated by a space, the answer should be modulo 998244353.

Examples

standard input	standard output
2 2 1 3	6
5 2 2 7 5	25200 2220

Note

Explain the first test case :

Lets say that :

- Bucket 1 has 2 balls of color 1
- Bucket 2 has 2 balls of color 2

If Elgoker picks 3 balls, the different combinations will be :

- 1-1-2
- 1-2-1
- 1-2-2
- 2-2-1
- 2-1-2
- 2-1-1

Problem H. Hebron: A City of Ancient Heritage

Input file:	standard input
Output file:	standard output
Balloon Color:	Yellow

Hebron, in the southern West Bank of Palestine, is one of the world's oldest continuously inhabited cities, with over 4,000 years of history. It holds significant religious importance for Muslims, Jews, and Christians, particularly for the Cave of the Patriarchs, or Ibrahimi Mosque. The old city features traditional stone buildings and bustling markets, reflecting its rich cultural heritage and historical role as a trade center. Despite the conflict, Hebron remains a vibrant cultural and religious hub in Palestine.

You will be given two integers n and k, and you are required to construct a permutation where every subarray of length k is greater than its previous subarray by 1.

Specifically, $Sum(a_i + a_{i+1} + ... + a_{i+k-1}) = Sum(a_{i-1} + a_i + ... + a_{i+k-2}) + 1$, must hold for all i where $(2 \leq i \leq n - k + 1)$.

A permutation is a sequence of integers from 1 to n of length n containing each number exactly once. For example, (1), (4, 3, 5, 1, 2), (3, 2, 1) are permutations, and (1, 1), (4, 3, 1), (2, 3, 4) are not.

Input

Only one line contains two integers n and k $(1 \leq k \leq n \leq 10^5)$.

Output

Print a permutation of length n that satisfies the above condition.

If several solutions are possible, print any one of them.

Examples

standard input	standard output
5 3	4 1 3 5 2
4 1	1 2 3 4

Problem I. Irbid: A Historical City in Palestine

Input file:	standard input
Output file:	standard output
Balloon Color:	Pink

Irbid, in the northern West Bank of Palestine, is a city rich in history and cultural significance, with continuous settlement since the Bronze Age. Known for ancient ruins and landmarks like Tell Irbid, it reflects diverse influences from Canaanite, Roman, Byzantine, and Muslim civilizations. Today, Irbid is a bustling urban center with educational institutions, industries, and vibrant community life, serving as a regional hub for commerce and culture.

You are given a tree with n nodes, rooted at 1, and an integer s.

You have to count the number of ways to assign a digit from 0 to 9 to every node in the tree such that for every path from the root to some leaf if you write the digits on the nodes of the path in order from the root to that leaf, the resulting number num should satisfy $num \leq s$.

Input

The first line of input contains a single integer n the number of nodes ($1 \leq n \leq 10^5$).

The next n - 1 lines contain two values each u and v denoting the edges (u, v) in the tree.

The next line cotains a single integer m the number of digits in s ($1 \leq m \leq 10^5$).

The next line contains the integer s ($1 \leq s \leq 10^{100000}$).

Output

The number of ways to set values on the tree modulo $10^9 + 7$.

Examples

standard input	standard output
3 1 2 1 3 2 10	101
3 1 2 2 3 1 8	9

Note

in the first sample if you put digit 0 in node 1 then you can put any digit from 0 to 9 in both nodes 2 and 3 so the number of assingments will be 10 * 10 = 100 and if you put digit 1 in node 1 then you can only put digit 0 in both 2 and 3 so there is only 1 way to assign in that case so the answer is 101

in the second sample we can only put digit 0 in both nodes 1 and 2 and we can put any digit from 0 to 8 in node 3 so the answer is 9

Problem J. Jericho: The Oldest City in the World

Input file:	standard input
Output file:	standard output
Balloon Color:	Silver

Jericho, in the West Bank of Palestine, is renowned as one of the oldest continuously inhabited cities, with a history spanning over 10,000 years. It boasts a lush oasis and Ain es-Sultan spring, pivotal to its ancient settlements and strategic role along trade routes. Archaeological excavations reveal layers of civilizations, from the Natufian era to the present times, echoing its rich cultural heritage. Mentioned in biblical texts for its fortified walls and the Battle of Jericho, Jericho stands as a testament to enduring human civilization and historical significance.

The last ACPC was held in Luxor, and *Hamoya* and *histeammate* wonder where ACPC will be in the next year.

Hamoya believes that it will be in "Luxor" by $A\%$, *histeammate* believes that it will be in "Sharm El-shaikh" by $B\%$.

print where ACPC will be in the next year or it is **impossible to define, where the higher percentage is the correct prediction.**

Input

Only one line contain A, B $(1 \leq A, B \leq 100), A + B = 100$.

Output

print where ACPC will be in the next year or it is impossible to define.

Examples

standard input	standard output
20 80	Sharm El-shaikh
60 40	Luxor
50 50	impossible

Problem K. Khan Yunis: A Cultural Hub in Gaza

Input file:	standard input
Output file:	standard output
Balloon Color:	Green

Khan Yunis, in the southern Gaza Strip of Palestine, is a historic city steeped in cultural heritage and community vitality. Its name, "Caravansary of Yunis"in Arabic, signifies its past as a vital trading hub along ancient routes. From archaeological sites to traditional markets and narrow streets, Khan Yunis preserves remnants of ancient civilizations and reflects a diverse cultural tapestry shaped by centuries of history. Today, it remains a vibrant testament to Gaza's rich heritage and enduring resilience.

You are given 2 circles. Find the area of the largest crescent moon shape (Helal).

A Helal is defined as a circular shape missing a segment from its border. See further details for illustrations.

Note that even if two circles are concentric with the same radius, they do not form a Helal.

Input

The first line contains three integers $x1, y1, r1$ ($-10^6 \le x1, y1 \le 10^6, 1 \le r1 \le 10^6$) — the position of the center and the radius of the first circle.

The second line contains three integers $x2, y2, r2$ ($-10^6 \le x2, y2 \le 10^6, 1 \le r2 \le 10^6$) — the position of the center and the radius of the second circle.

Output

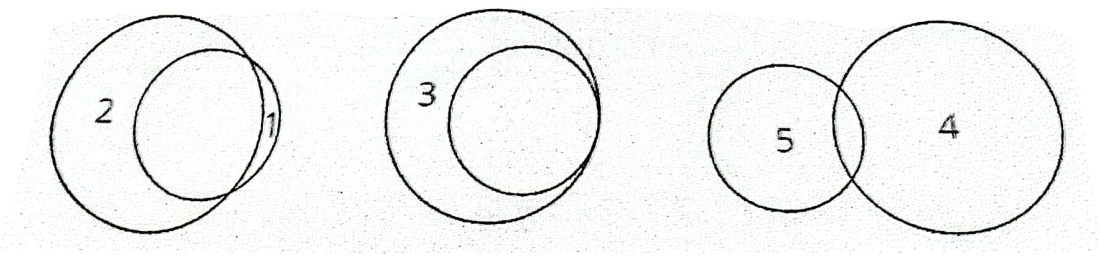
Print the area of the maximum Helal, if not possible print "-1" without quotations. The answer will be considered correct if the absolute or relative error doesn't exceed 10^{-4}.

Examples

standard input	standard output
0 0 5 3 0 2	65.97344572538565543596
5 4 2 0 0 5	77.52695676399128011159
0 0 1 -10 0 1	-1

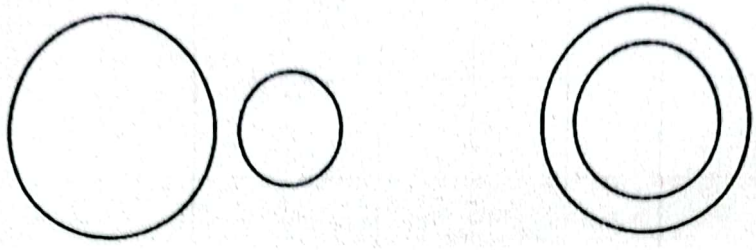
Note

The following areas from 1-5 are valid Helals:



All of them are circles but missing a circular part from their borders.

The following circles can't form any Helals:



The first 2 circles don't even intersect, the second 2 are concentric so not intersecting from the border.

Problem L. Lifta: A Historic Village near Jerusalem

Input file:	standard input
Output file:	standard output
Balloon Color:	Gold

Lifta, a historic Palestinian village near Jerusalem's western entrance, boasts terraced gardens, ancient architecture, and deep cultural significance. Inhabited since ancient times, its name, from the Aramaic "lofta,"reflects its enduring heritage. Despite being depopulated in 1948, Lifta's well-preserved stone houses and natural springs remain, drawing visitors to explore its rich history and architectural beauty. Efforts to preserve Lifta as a cultural site underscore its role in Palestinian heritage and ongoing struggles for recognition.

Given a tree with N nodes, numbered from 1 to N, each node's value is its number.

Count the number of pairs (i, j) such that there is at least one node whose value is prime in the simple path between i and j. Note that (i, j) is considered the same as (j, i).

Input

First line contains one integer N $(1 \leq N \leq 2 * 10^5)$

Then there will be $N - 1$ lines contain two integers u, v $(1 \leq u, v \leq N)$ which means that there an edge between u, v.

Output

Output the numbers of pair (i, j) such that there is a prime node in the simple path between (i, j).

Example

standard input	standard output
6 4 6 2 6 1 2 4 5 1 3	14

Problem M. Marj Ibn Amer: Historical Plain in Palestine

Input file:	standard input
Output file:	standard output
Balloon Color:	Light Green

Marj Ibn Amer, in the northern West Bank of Palestine, is a historic agricultural plain celebrated for its fertile soil and cultural significance. Named "Plain of Ibn Amer"in Arabic, it has sustained olive groves, wheat fields, and orchards for centuries, crucial to the region's agricultural economy. A crossroads of civilizations from Canaanites to Muslims, its strategic location along ancient trade routes has shaped its prosperity and cultural diversity. Today, Marj Ibn Amer continues as a vibrant agricultural area, preserving traditional farming practices and attracting visitors with its picturesque landscapes and rich historical heritage.

Hamoya is a beginner in programming. He also invented a new game called (Bob the Robber) in his second program.

Players must write some instructions that help the robber to escape.

The robber is on an $n * m$ board (marked with the letter R), which always starts at the **bottom-left** field, facing right. The board contains empty squares (marked as .), brick walls (#), wooden walls (W), stairs (S), and some elevators ($a : e$) and their keys ($A : E$). The getaway is marked with a G.

The robber cannot move on brick walls only.

A robber program contains 6 kinds of instructions:

- F The robber moves one field forward in the direction he is facing. A program error occurs if the robber faces a rock or the border of the board.
- R The robber changes his direction to the right (the robber will stay on the same field).
- L The robber changes his direction to the left (the robber will stay on the same field).
- B The robber breaks the wooden wall in the direction it is facing. If the square it faces contains a wooden wall, the wooden wall will be destroyed and the square will turn into an empty square. Otherwise, a program error occurs.
- U The robber goes to the top floor by stairs or elevators. (i.e., if the robber is in cell (x, y), he will be in cell $(x-1, y)$). A program error occurs if the robber faces the border of the board.
- D The robber goes to the bottom floor by stairs or elevators (i.e., if the robber is in cell (x, y), he will be in cell $(x+1, y)$).A program error occurs if the robber faces the border of the board.

Note:

- he can go up (in instructions U) or down (in instructions D) by stairs or elevators, which means he must stand on a cell containing a character indicating stairs or elevators.
- Stairs do not need a key, but the elevator needs a key of the same kind.
- One key is enough to open all elevators of the same kind.
- There is at most one key of each type.

- All stairs and elevators are valid and take you inside the border of the grid.
- All stairs and elevators are not shared between each other.

Input

First line contain n, m $(1 \leq n, m \leq 20)$

The input consists of n lines, which represent the board, with each line representing one row of m characters. The robber will always start at the bottom left.

Output

Output the shortest valid program instructions that execute (without program error).

Print no way if the robber can't escape!

Examples

standard input	standard output
4 4 a..G a.WS ..SS R.SA	FFFLFRUFLUBFFFURFFF
3 3 S.G S.a RAa	FFULFFURFF
5 5 S.B.b Sa#Cb SaA#. SS#c. RS#cG	no way