

The Protolympics'24

Easy (5 points each)

1. **Essay Check:** Salama is organizing a writing contest which you're participating in, where each essay must contain a minimum number of words. Given a **string** representing your essay and an **integer** representing the minimum word count, determine if the essay meets the required word count.

Input:

Output:

This is a short essay.

5

Essay passes!

A very short one.

5

Essay fails!

2. **Pig Latin:** Pig Latin is a secret language which is similar to English. To convert an English word to Pig Latin, take the first letter of that word, move it to the end, and then add "ay". Given a **string** of English words, convert it to Pig Latin.

Input:

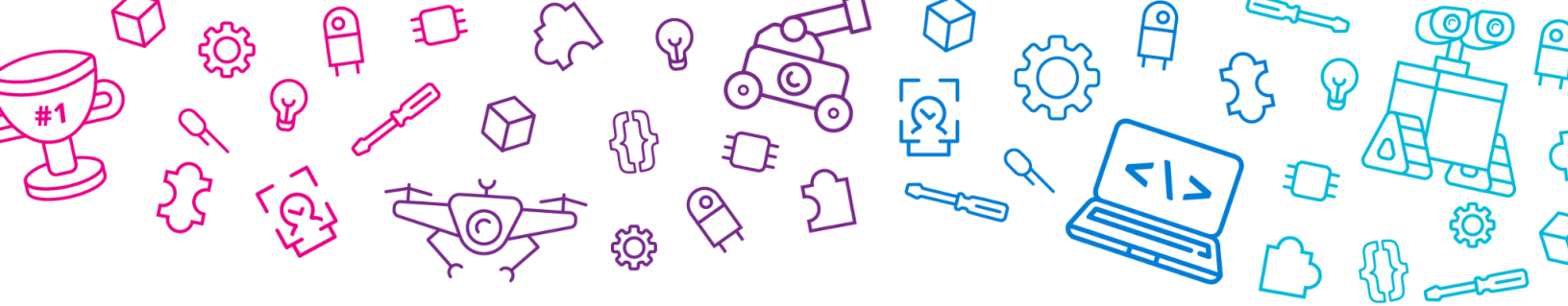
Output:

Hello world

Ellohay orldway

Protons rock

Rotonspay ocksray



3. **Montaza:** El-Montaza is a famous garden in the city of Alexandria. To prepare for a special event, the city decided to cover the garden with square tiles. Assume the garden is rectangular with dimensions of $n \times m$ meters, and each tile is $a \times a$ meters in size. What is the minimum number of tiles required to cover the entire park? It's okay if the tiles extend beyond the edges of the park, but the whole park must be covered. The tiles can't be cut or broken, and they must be placed with their sides parallel to the sides of the park. Given 3 integers n , m and a , print the minimum number of tiles needed.

Input:

6 6 4

Output:

4 tiles

4. **Sorted Search:** Ziyad needed to find a special number in a long sorted list. Instead of searching through each number one by one, he wants to find it in a more efficient way. Given a sorted list of integers, and an integer to search for, print the index of this integer or if it's not found. Your code should run in $O(\log n)$.

Input:

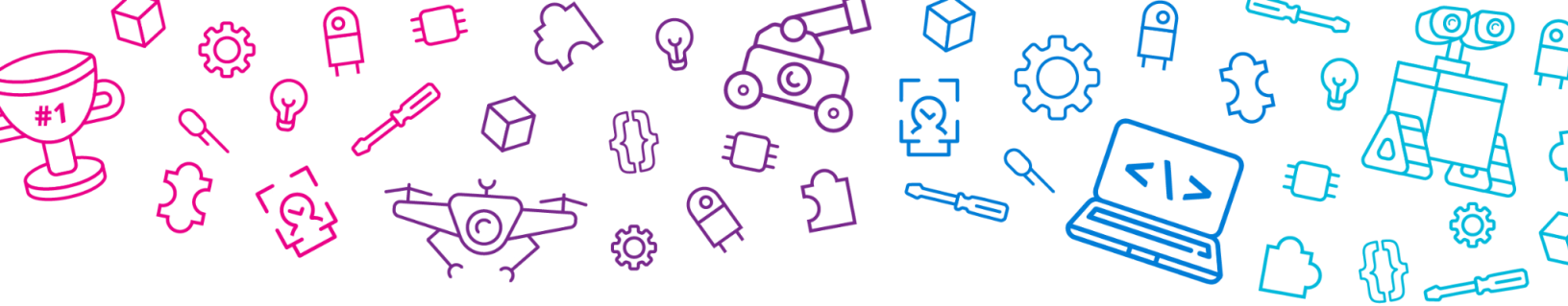
1 4 5 7 9 13 16

Output:

4

1

5. **Clumpy List:** Ziyad has his own list of integers, however he thinks his list is quite clumpy and long, so he decides to clean it. He wants to remove all the duplicates, and keep only distinct values. Given a **list of integers**, print the list without duplicates.



Input:

3 5 9 2 5 2 4 3 1

21 45 95 21 34 95 45

Output:

3 5 9 2 4 1

21 45 95 34

6. **Anagram Check:** Two strings are considered anagrams if they contain the same letters with the same count. Given **2 strings**, find out if they're anagrams of each other or not.

Input:

dormitory

dirty room

protons

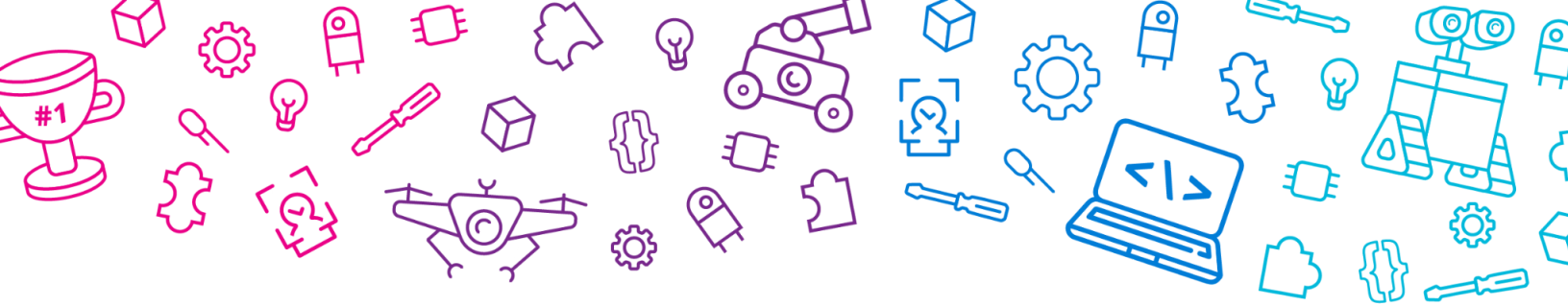
rock

Output:

Anagrams!

Not Anagrams!

7. **The Hacker:** Tamim wants to hack his brother's phone to make an important call, Tamim's brother's phone password consists of 4 digits. Tamim needs your help to develop a program that generates all possible passwords to find the correct password for his brother's phone.



8. **Anti-Hacker:** Tamim's brother found out that his phone got hacked, so he wants to come up with a strong password. Help him decide if his password is strong enough. A strong password should contain at least 4 lower case letters, at most 3 upper case letters, and exactly 4 digits, and at least one symbol. Given a string, find if it's a strong password or not.

Input:

\$hello12WTH98

protonsrocks!

Output:

Strong Password!

Weak Password!

9. **Awesome Number:** Tamim wants to check if his number is awesome or not. A number is called awesome if its first and last digits are odd. Given an **integer**, find if it's awesome or not.

Input:

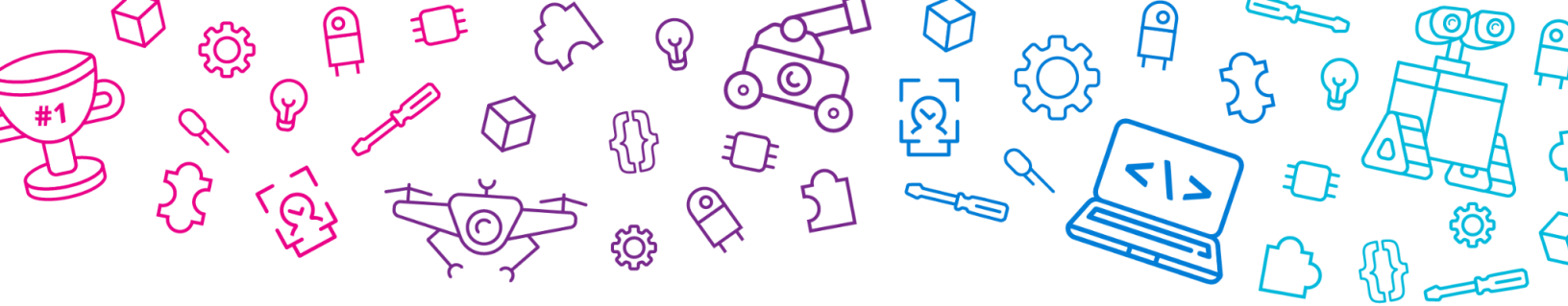
12546879

87410

Output:

Awesome!

Not Awesome!



Medium (10 points each)

10. **The Protolympics:** You are participating in the Protolympics, where you have a set of problems divided into three categories: easy, medium, and hard. Each category offers a different number of points based on the problem's difficulty, and each requires a specific amount of time to solve. Easy, medium, and hard gives you 5, 10, and 20 points respectively, and takes 10, 15, and 20 minutes respectively. Given a **list of 3 integers** representing the number of easy, medium and hard problems, and an integer for the total available time, calculate the maximum score you can get.

Input:

Output:

2 4 6

120

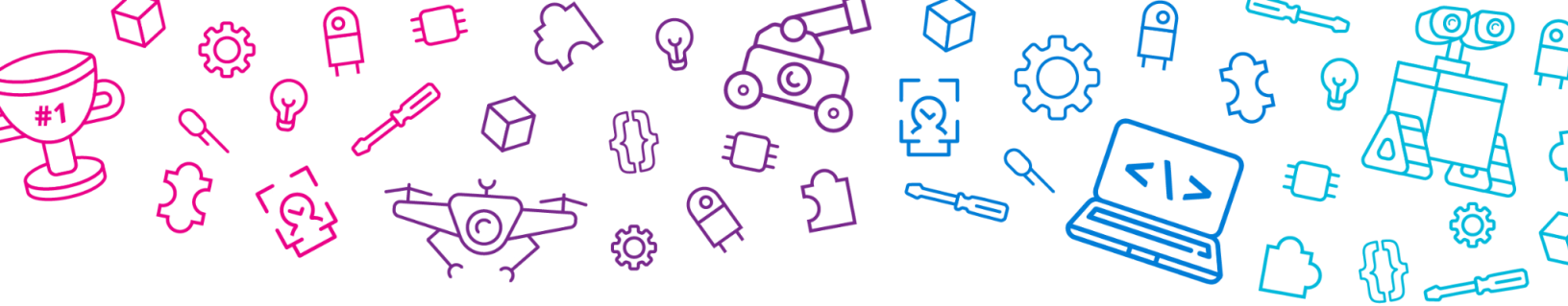
120 # 6 hard problems

2 4 6

115

115 # 5 hard + 1 medium problems

11. **Merge Sort:** Ziyad has two sorted lists and needs to combine them into one sorted list. However, he doesn't want to re-sort it and he wants the list to be sorted while merging along. Given **2 sorted lists of integers**, merge them together and return the merged list sorted. Your code should run in $O(n)$.



Input:

1 5 6 9

2 3 5 7 8

Output:

1 2 3 5 5 6 7 8 9

12. **List Difference:** Ziyad was organizing his two collections of rare coins. The first collection was her prized possession. The second collection was one he had just acquired from a collector. He wanted to know which coins were unique to his original collection, ones that couldn't be found in the new batch. Given **2 lists of integers**, return the distinct integers that are found in the first list but not in the second list.

Input:

1 2 3

2 4 6

1 2 3 3

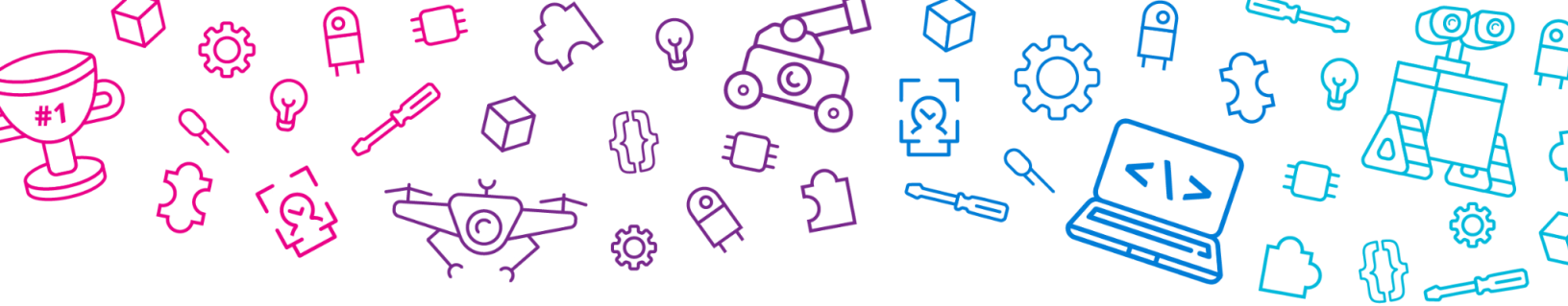
1 1 2 2

Output:

1 3

3

13. **Unique Occurrences:** In Souq Derbala, Ziyad noticed a strange pattern among the merchants. Each store had a different number of a particular item in their stalls, but Ziyad wondered if the number of items each vendor had was truly unique. Given **a list of integers**, find if the number of occurrences of each value in the list is unique or not.



Input:

1 2 2 1 1 3

1 2

Output:

unique # 1: 3, 2: 2, 3: 1

not unique # 1: 1, 2: 2

14. **LED Strips:** We want to decorate Electra using LED strips. Each LED strip can be one of 3 colors. How many lighting styles could we make if we have n strips?

Input:

3

6

Output:

27

729

15. **Coin Change:** After wandering for a while in Souq Derbala, Ziyad decides to buy groceries. The total price for the groceries bought is n Egyptian Pounds. Ziyad wants to pay using the least number of paper bills (200, 100, 50, 20, 10, 5, 1). Find out how many bills of each denomination will Ziyad pay.

Input:

147

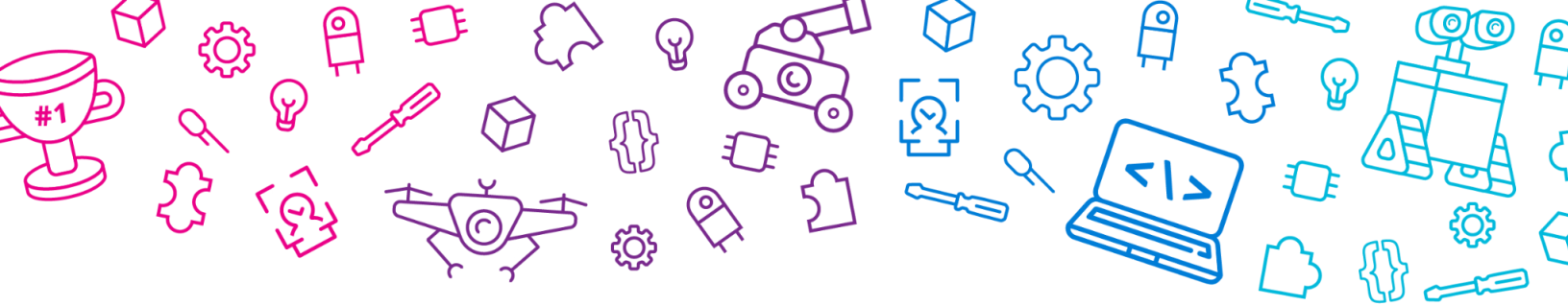
Output:

1x 100

2x 20

1x 5

2x 1



Hard (20 points each)

16. **String Best Fit:** You have two strings, **str1** and **str2**. A smaller string **t** can "fit into" a larger string **s** if you can make **s** by repeating **t** over and over. Your task is to find the longest string that can fit into both **str1** and **str2**.

Input:

Output:

ABCABC

ABC

ABC

ABABAB

ABAB

AB

PROTONS

ROCK

empty output

17. **Rotated Search:** You have a sorted list, however this list is rotated (or shifted). You need to search for the index of a specific value. Given a **list of integers** sorted and rotated and an **integer** to search for, print its index, or if it's not found. Your code should run in $O(\log n)$.

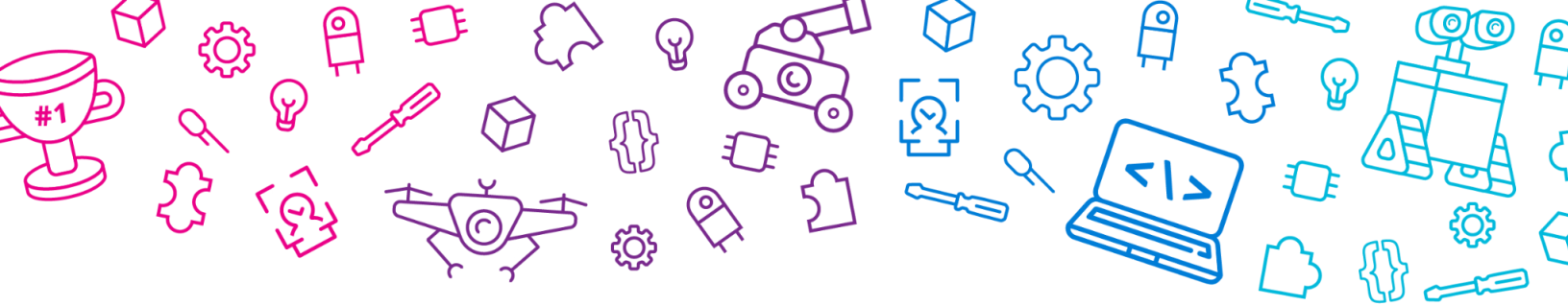
Input:

Output:

5 6 7 9 13 1 3 4

3

6



18. **Square Root:** You can perform basic mathematical operations in Python, however you need to calculate the square root of a number. Implement your own version of square root, without using any built-in functions or the exponentiation operator `"**"`. Your implementation is not required to work on non-perfect squares.
- **Bonus 5 points** for implementing it in $O(\log n)$.
 - **Bonus 5 points** for implementing it to work with non-perfect squares.

Input:

9

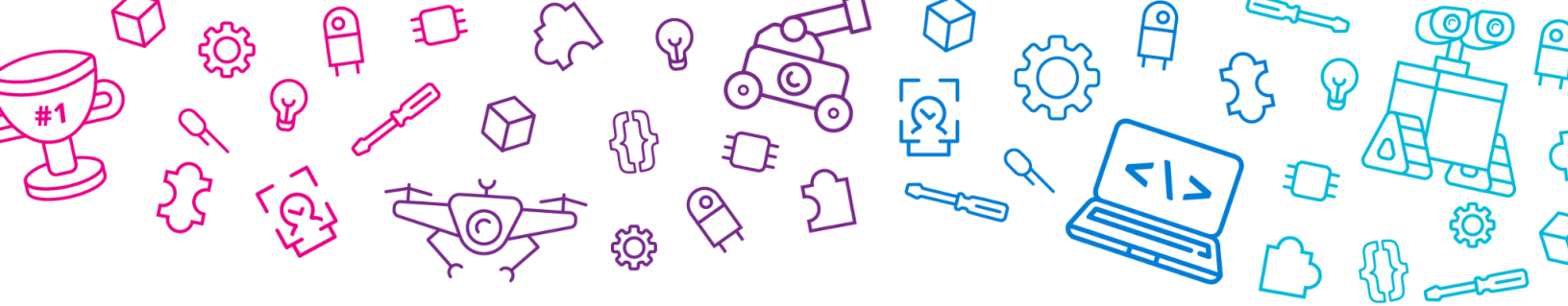
81

Output:

3

9

19. **Best Proton:** We need to choose the best Proton this year, based on some criteria: sessions attended, tasks submitted and workshops done. You have to give priority for the number of sessions attended, then tasks submitted, then workshops done. Given an **integer n** representing the number of Protons, then **n lists of 3 integers** representing the sessions attended, tasks submitted and workshops done for each Proton, sort them according to our criteria.



Input:

3

10 3 9

10 5 6

11 0 3

Output:

11 0 3

10 5 6

10 3 9

20. **ROV Tracking:** Ziyad went to a ROV competition and he knew that an underwater submarine moves in an ocean in 3 dimensions starting from the origin point (0,0,0). The submarine can move towards FORWARD, BACKWARD, UP, DOWN, LEFT and RIGHT. Ziyad is a member of AU-Robotics and his mission in the team was to find how far the submarine went from the centre. Given an integer n representing the number of moves, then followed by n lines each representing a move, find the final distance of the ROV from the origin.

Input:

3

FORWARD 5

RIGHT 4

BACKWARD 2

Output:

5