Assignment

INSTRUCTIONS

1. Answer any of the eight questions below with a pseudo algorithm.
2. Answer the other two with code in Python (upload on git and share the Git link).
3. Assignment should be submitted in 24hours time.

We define a magic square to be an $n \times n$ matrix of distinct positive integers from 1 to n^2 where the sum of any row, column, or diagonal of length n is always equal to the same number: the magic constant.

You will be given a 3×3 matrix s of integers in the inclusive range $[1, 9]$. We can convert any digit a to any other digit b in the range $[1, 9]$ at cost of $|a - b|$. Given s, convert it into a magic square at minimal cost. Print this cost on a new line.

Note: The resulting magic square must contain distinct integers in the inclusive range $[1, 9]$.

An arcade game player wants to climb to the top of the leaderboard and track their ranking. The game uses Dense Ranking, so its leaderboard works like this:

- The player with the highest score is ranked number 1 on the leaderboard.
- Players who have equal scores receive the same ranking number, and the next player(s) receive the immediately following ranking number.

Example

$ranked = [100, 90, 90, 80]$
$player = [70, 80, 105]$

The ranked players will have ranks 1, 2, 2, and 3, respectively. If the player's scores are 70, 80 and 105, their rankings after each game are 4^{th}, 3^{rd} and 1^{st}. Return $[4, 3, 1]$.

The factorial of the integer n, written $n!$, is defined as:

$$n! = n \times (n - 1) \times (n - 2) \times \cdots \times 3 \times 2 \times 1$$

Calculate and print the factorial of a given integer.

For example, if $n = 30$, we calculate $30 \times 29 \times 28 \times \cdots \times 2 \times 1$ and get $265252859812191058636308480000000$.

Given the time in numerals we may convert it into words, as shown below:

$$
\begin{aligned}
5{:}00 &\rightarrow \text{five o' clock} \\
5{:}01 &\rightarrow \text{one minute past five} \\
5{:}10 &\rightarrow \text{ten minutes past five} \\
5{:}15 &\rightarrow \text{quarter past five} \\
5{:}30 &\rightarrow \text{half past five} \\
5{:}40 &\rightarrow \text{twenty minutes to six} \\
5{:}45 &\rightarrow \text{quarter to six} \\
5{:}47 &\rightarrow \text{thirteen minutes to six} \\
5{:}28 &\rightarrow \text{twenty eight minutes past five}
\end{aligned}
$$

At $minutes = 0$, use o' clock. For $1 \leq minutes \leq 30$, use past, and for $30 < minutes$ use to. Note the space between the apostrophe and clock in o' clock. Write a program which prints the time in words for the input given in the format described.

Given an array of strings of digits, try to find the occurrence of a given pattern of digits. In the grid and pattern arrays, each string represents a row in the grid. For example, consider the following grid:

```
1234567890
0987654321
1111111111
1111111111
2222222222
```

The pattern array is:

```
876543
111111
111111
```

The pattern begins at the second row and the third column of the grid and continues in the following two rows. The pattern is said to be present in the grid. The return value should be `YES` or `NO`, depending on whether the pattern is found. In this case, return `YES`.

In this challenge, you are required to calculate and print the sum of the elements in an array, keeping in mind that some of those integers may be quite large.

Given five positive integers, find the minimum and maximum values that can be calculated by summing exactly four of the five integers. Then print the respective minimum and maximum values as a single line of two space-separated long integers.

Example

$arr = [1, 3, 5, 7, 9]$

The minimum sum is $1 + 3 + 5 + 7 = 16$ and the maximum sum is $3 + 5 + 7 + 9 = 24$. The function prints

```
16 24
```

You are choreographing a circus show with various animals. For one act, you are given two kangaroos on a number line ready to jump in the positive direction (i.e, toward positive infinity).

- The first kangaroo starts at location $x1$ and moves at a rate of $v1$ meters per jump.
- The second kangaroo starts at location $x2$ and moves at a rate of $v2$ meters per jump.

You have to figure out a way to get both kangaroos at the same location at the same time as part of the show. If it is possible, return YES, otherwise return NO.

For example, kangaroo 1 starts at $x1 = 2$ with a jump distance $v1 = 1$ and kangaroo 2 starts at $x2 = 1$ with a jump distance of $v2 = 2$. After one jump, they are both at $x = 3$, ($x1 + v1 = 2 + 1$, $x2 + v2 = 1 + 2$), so our answer is YES.

Maria plays college basketball and wants to go pro. Each season she maintains a record of her play. She tabulates the number of times she breaks her season record for most points and least points in a game. Points scored in the first game establish her record for the season, and she begins counting from there.

For example, assume her scores for the season are represented in the array $scores = [12, 24, 10, 24]$. Scores are in the same order as the games played. She would tabulate her results as follows:

```
                          Count
Game  Score  Minimum  Maximum   Min Max
 0     12     12       12       0   0
 1     24     12       24       0   1
 2     10     10       24       1   1
 3     24     10       24       1   1
```

Given the scores for a season, find and print the number of times Maria breaks her records for most and least points scored during the season.

You have been asked to help study the population of birds migrating across the continent. Each type of bird you are interested in will be identified by an integer value. Each time a particular kind of bird is spotted, its id number will be added to your array of sightings. You would like to be able to find out which type of bird is most common given a list of sightings. Your task is to print the type number of that bird and if two or more types of birds are equally common, choose the type with the smallest ID number.

For example, assume your bird sightings are of types $arr = [1, 1, 2, 2, 3]$. There are two each of types 1 and 2, and one sighting of type 3. Pick the lower of the two types seen twice: type 1.