PRACTICE SHEET

What you will learn :

Loops & Control Flow, Mathematical Sequences, Probability & Pattern Observation, Pattern Printing, String Manipulation & Formatting, Subsequence Analysis, Number Theory & Digit-Based Rules, Grid Movement & Parity Check

[EASY] Q1) What is the output of the following?

```
x = 0
while x < 5:
    x += 1
    if x == 3:
        break
print(x)
```

[EASY] Q2) A locker accepts a secret number. You are allowed to try only **3 times**. If you guess it correctly, it should say "Unlocked", otherwise it says "Try again".

Secret password is 1234

Hint : use while loop

[EASY] Q3)

i) Display the Arithmetic Progression (AP) - 4, 7, 10, 13, 16... up to ‘n’ terms.
Given the first term a = 4 and the common difference d = 3, generate the arithmetic progression (AP) up to n terms.

Input Format: A single integer n representing the number of terms to display.

Output Format: A list of integers representing the AP sequence.

ii) Display the Geometric Progression (GP) - 3, 12, 48,... up to ‘n’ terms.

Given the first term a = 3 and the common ratio r = 4, generate the geometric progression (GP) up to n terms.

Input Format: A single integer n representing the number of terms to display.

Output Format: A list of integers representing the GP sequence.

[EASY] Q4) n passengers board an airplane with exactly n seats. The first passenger has lost the ticket and picks a seat randomly. But after that, the rest of the passengers will:

- Take their own seat if it is still available, and
- Pick other seats randomly when they find their seat occupied

Return the probability that the n^{th} person gets his own seat. [LEETCODE 1227]

Example 1:

Input: n = 1

Output: 1.00000

Explanation: The first person can only get the first seat.

Example 2:

Input: n = 2

Output: 0.50000

Explanation: The second person has a probability of 0.5 to get the second seat (when first person gets the first seat).

HINT : Observe the Pattern -

For n = 1, probability = 1.0.

For n = 2, probability = 0.5.

For n = 3, probability = 0.5.

For n = 4, probability = 0.5.

[EASY] Q5) There are n bulbs that are initially off. You first turn on all the bulbs, then you turn off every second bulb. On the third round, you toggle every third bulb (turning on if it's off or

turning off if it's on). For the i^{th} round, you toggle every i bulb. For the n^{th} round, you only toggle the last bulb. Return the number of bulbs that are on after n rounds.

Input: n = 3

Output: 1

Explanation: At first, the three bulbs are [off, off, off].

After the first round, the three bulbs are [on, on, on].

After the second round, the three bulbs are [on, off, on].

After the third round, the three bulbs are [on, off, off].

So you should return 1 because there is only one bulb is on.

Hint : A bulb ends up **on** only if it is toggled an **odd number of times**. Bulb k is toggled once for each of its divisors. Only numbers with an **odd number of divisors** (perfect squares) remain on

[EASY] Q6) Create a password generator that takes your **first name**, **birth year**, and **favourite color** and converts it into a funny password like:

- 1st letter of name in uppercase
- Reverse of birth year
- First 2 letters of color in uppercase.

[MEDIUM] Q7) Write a simple interpreter that can execute string commands like "print(5 + 10)".

[MEDIUM] Q8) Luffy is playing Need For Speed. Currently, his car is running on a straight road with a velocity U metres per second and approaching a 90° turn which is S metres away from him. To successfully cross the turn, velocity of the car when entering the turn must not exceed V metres per second.

The brakes of Luffy's car allow him to slow down with a deceleration (negative acceleration) not exceeding A metres per squared second. Tell him whether he can cross the turn successfully. The velocity v when entering the turn can be determined from Newton's 2nd law to be

$v^2 = U^2 + 2 \cdot a \cdot S$ if the car is moving with a uniform acceleration a.

Input Format : You are given four space-separated integers: U V A S

Where, U: Initial velocity of the car (in m/s), V: Maximum allowed velocity at the turn (in m/s),

A: Maximum allowed deceleration (in m/s^2), S: Distance from the car to the turn (in meters)

Output Format : Print

- "Yes" if Chef can safely take the turn.
- "No" otherwise.

Examples :

Input: 1 1 1 1

Output: Yes

Input: 2 1 1 1

Output: No

Input: 2 2 1 1

Output: Yes

Example case 1: Since U=V=1, Chef does not need to brake and will be able to turn successfully.

Example case 2: The smallest velocity Chef's car can have even with the maximum deceleration is $\sqrt{2 \cdot 2 - 2 \cdot 1 \cdot 1} = \sqrt{2}$ which is greater than the maximum allowed velocity for a safe turn.

Example case 3: The smallest velocity Chef's car can have with the maximum deceleration is again $\sqrt{2}$, which is smaller than the maximum allowed velocity for a safe turn.

[MEDIUM] Q9) You are given an integer N. Consider the sequence containing the integers 1,2,…,N in increasing order (each exactly once). Find the maximum length of a contiguous subsequence with an even sum. A subsequence is a sequence that can be derived from another sequence by deleting some or none of the elements, without changing the order of the remaining elements.

Input Format: The first and only line contains a single integer N.

Output Format: Print a single line containing one integer - the maximum length of a contiguous subsequence with an even sum.

Input	-	Output
3	-	3
4	-	4
5	-	4

Explanation:

For N=3 , the entire sequence [1,2,3] has sum 6, which is even. So the answer is 3.

For N=5, the subsequence [1,2,3,4] has sum 10, which is even. So the answer is 4.

[HARD] Q10) There is a grid of size $10^5 \times 10^5$, covered completely in railway tracks. Tom is riding in a train, currently in cell (a,b), and Jerry is tied up in a different cell (c,d), unable to move. The train has no brakes. It shall move exactly K steps, and then its fuel will run out and it shall stop. In one step, the train must move to one of its neighboring cells, sharing a side. Tom can't move without the train, as the grid is covered in tracks. Can Tom reach Jerry's cell after exactly K steps?

Note: Tom can go back to the same cell multiple times.

Input Format : Input contains five integers a,b,c,d,K.

Output Format : Output in a single line "YES" if Tom can reach Jerry's cell in exactly K moves and "NO" if not.

Input	-	Output
1 1 2 2 2	-	YES
1 1 2 3 4	-	NO
1 1 1 0 3	-	YES

Explanation:

Test Case 1: A possible sequence of moves is (1,1)→(1,2)→(2,2).

Test Case 2: There is a possible sequence in 3 moves, but not in exactly 4 moves.

Test Case 3: A possible sequence of moves is (1,1)→(1,0)→(0,0)→(1,0).

Hint : To determine if Tom can reach Jerry in exactly K steps, check two conditions:

1. The Manhattan distance between the starting and target positions must be ≤ K.
2. The difference K - distance must be even (so that Tom can make the extra steps by moving back and forth).

If both conditions are satisfied, the answer is "YES"; otherwise, it's "NO".

[EASY] Q11) Print the following pattern

Input: n = 4

Output:

```
*
**
***
****
***
**
*
```

[HARD] Q12) Print the following pattern

Input: n = 4

Output:

```
A B C D E F G
A B C     E F G
A B           F G
A                 G
```

[EASY] Q13) A chemical reaction completes after 90% of reactants are used. Initially, 100 grams of reactants exist. Every hour, 10% of remaining reactant is used. Simulate and print the number of hours it takes to complete the reaction.

Hint : Use while loop and % math.

Output : Reaction completed in 22 hours

[MEDIUM] Q14) Meow wants an N-digit odd positive integer X that satisfies:

1. Divisible by 3 (sum of digits is divisible by 3).
2. Not divisible by 9 (sum of digits is not divisible by 9).
3. No leading zeros.

You can give any N-digit number.

Hint :

Input (N)	**Output**
1	3
2	33
3	303
4	3003

[MEDIUM] Q15) Check if a Number is a Disarium Number.

Disarium Number Definition:
A number is called a Disarium number if the sum of its digits raised to the power of their respective positions is equal to the number itself.

Example:

- 175 is a Disarium number because:
  $1^1+7^2+5^3 = 1+49+125 = 175$
- 20 is not a Disarium number because:
  $2^1+0^2 = 2+0 = 2 \neq 20$