National University of Computer and Emerging Sciences

Fast School of Computing   Fall 2025

CS-1002 – PF (CS Department)
Assignment 1
Section: *All sections*
Submission Deadline: *5 PM - 14th September 2025*

Submission Instructions:

1. Assignments are to be done individually. You must complete this assignment by yourself. You cannot work with anyone else in the class or with someone outside of the class for this assignment. The flowcharts you make must be your own, and you must understand each part of your flowcharts. You are encouraged, however, to get help from the instructional staff through Google Classroom.

2. Plagiarism: Plagiarism of any kind (copying from others, copying from the internet or using AI, etc.) is not allowed. If found plagiarised, you will be awarded zero marks in the whole assignment category. Repeating such an act can lead to strict disciplinary actions and failure in the course.
   Do note that AI and plagiarism will be thoroughly checked across the batch and different LLMs. If any hint of similarity is found, strict action will be taken.

3. A demo for this assignment will be held, where plagiarism and solutions to the assignment's questions will be assessed, and marks for the assignment will be given accordingly.

4. Please start early; otherwise, you will struggle with the assignment.

5. **Keep an eye out for the comments on the assignment. Sometimes queries are asked in the comments, which add constraints to the questions of the assignment.**

6. **The query deadline will be the 5th Of September – 5PM. No query will be entertained after that.**

7. All queries must be asked only in the Google Classroom comment section for the assignment, allowing others with similar questions to be able to have the answers to their questions.

8. If you have a query, kindly check if anyone has already asked a similar query beforehand.
   If you are reading this, whilst attempting the second question, write your grade point average expectations in the right-hand corner and get a reward, and no snitching, the more people know, the lesser the rewards get

9. **Submission Guidelines:**
   - Compile all the flowcharts in the order of the question as a single PDF file, where every wording must be clearly visible.
   - Make sure your roll number, name, and question number are written on every page.
   - Failure to do so will lead to nullification of the whole assignment.

- **The file that needs to be submitted will be using the following naming convention:** *ROLLNUMBER_SECTION.pdf* (e.g. 25i-0001_A.pdf).
- **Keep in mind**, only a PDF file will be acceptable.
- Submit the .pdf file on Google Classroom only within the deadline. Submissions on emails will not be accepted.
- Try to submit at-least 1 hour before the deadline to tackle potential internet issues regarding the submission.
- Submissions other than Google Classroom (e.g. email, etc.) will not be accepted.
- The student is solely responsible for checking the final PDF files for issues like corrupt files, sent. If we cannot download the file from Google Classroom for any reason, it will lead to zero marks in the assignment.

Note: Follow the given instructions; failing to do so may result in a zero in this assignment.

Key Tip as a TA: **DO NOT** ask queries when they may add constraints to your questions. If there are no constraints, let there be none and utilise that to your advantage and do the question in the manner that suits you, rather than making it more difficult for everyone involved.

Sample Question:
[Solution has already been provided in the sample submission. Do not solve this]

The Weather Station Mystery

A remote weather station has been sending garbled temperature readings. The data comes in different formats - sometimes Celsius, sometimes Fahrenheit, sometimes Kelvin - but you can only tell if it's safe to send the rescue team if you know the Celsius temperature.

Your mission: Take any temperature reading, convert it to Celsius, and determine if conditions are Cold (below 15°C) or Warm (15°C and above) for the rescue operation.

Create a flowchart showing how to process these weather readings.

Question Number 1 [10 Marks]

In *Avengers*, Doctor Strange is checking possible future timelines. However, his spell only works correctly in **leap years**.

Task: Draw a flowchart that takes a year as input and checks if it is a leap year.

- If the year is a leap year, display: "Leap Year; Doctor Strange can travel."
- Otherwise, display: "Not a Leap Year; Spell fails."

Example:

Input Year	Result	Output Message
2000	Leap Year	Leap Year; Doctor Strange can travel.
1900	Not Leap Year	Not a Leap Year; Spell fails.
2020	Leap Year	Leap Year; Doctor Strange can travel.
2021	Not Leap Year	Not a Leap Year; Spell fails.
2400	Leap Year	Leap Year; Doctor Strange can travel.

Question Number 2 [5 Marks]

Exact Instructions Challenge - Ramen Edition | Josh Darnit

Have a look at the video above. Create a flow-chart for the same task as assigned in the video to the children, whilst trying to be as precise as possible with your instructions to prevent errors, as seen in the video.

Question Number 3 [10 Marks]

Drew Binsky, a famous YouTuber from the USA, loves to travel the globe, and in his recent visit to Pakistan, he fell in love with Pakistani tea. You, being his friend, have been asked to make a flowchart showcasing the steps of making a tea so that Drew can make the perfect tea for his wife when he returns to the USA. Keep in mind, Drew loves following instructions, but he doesn't like to do stuff that he isn't told to do, so try to keep the flowchart as precise and accurate as possible.

Question Number 4 [10 Marks]

Flex is currently experiencing a server outage. As a result, several core computational services are unavailable. To ensure that essential operations continue without interruption, the IT department has assigned you the task of designing an algorithm that can reliably convert decimal numbers into their binary equivalents. Your solution should be clearly represented through a flowchart, showing complete conversion from a **decimal number** to its **binary** equivalent.
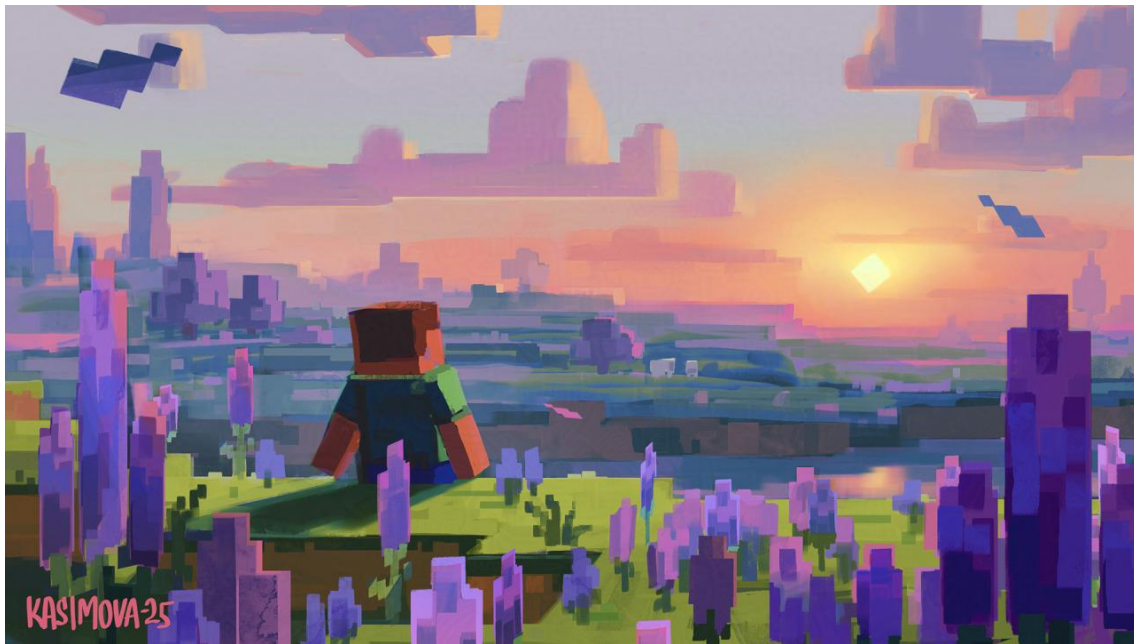
Take your complete roll number (e.g., 25i-0606, 23k-1234, etc.)

Extract the **last 4 digits** from your roll number

If your roll number is 25i-0606, then the last 4 digits are 0606, then the decimal number is 606 (leading zeros can be ignored: 0606 → 606)

Create a comprehensive dry run table following your flowchart to convert your extracted number to binary.

Question Number 5 [10 Marks] :

In the video game *Minecraft*, a player wants to craft wooden planks. Each time they cut down 1 tree, they get 4 planks.

However, due to a bug in the game, the "×" (multiplication) feature is disabled, and the crafting system only supports addition.

You need to design an algorithm that acts as a backup support till the * operator is back.

Draw a flowchart that calculates how many planks the player will get if they cut down T number of trees.

- **You cannot use the multiplication * operator.**
- Input: number of trees (T)
- Output: total number of planks

Example:

Input Trees (T)	Planks Calculated	Output Message
1	4	Player gets 4 planks.
2	8	Player gets 8 planks.
3	12	Player gets 12 planks.

5	20	Player gets 20 planks.
7	28	Player gets 28 planks.
10	40	Player gets 40 planks.

Question Number 6 [15 Marks]:

The Change Machine

Imagine you're playing **Squid Game** (Netflix). You just survived the daunting "Red Light, Green Light," and now you're in the next stage: **"The Change Machine."**

The Front Man appears and says:

*"Player 456, you have been given some amount of Pakistani Rupees. To survive this round, you must break your money into notes and coins... but only in the **least number of pieces possible**. If you fail, you're eliminated."*

You're allowed denominations of: 5000s, 1000s, 500s, 100s, 50s, 20s, 10s, 5s, 2s, 1s.

Just like in the Squid Game arena, hesitation means failure.

Example:

Input Amount (Rs)	Breakdown of Notes/Coins	Total Notes/Coins	Output Message
8423	1×5000, 3×1000, 4×100, 1×20, 1×2, 1×1	11	Player receives 1 note of 5000, 3 notes of 1000, 4 notes of 100, 1 note of 20, 1 coin of 2, 1 coin of 1. Total = 11 pieces.
7688	1×5000, 2×1000, 1×500, 1×100, 1×50, 1×20, 1×10, 1×5, 1×2, 1×1	10	Player receives 1 note of 5000, 2 notes of 1000, 1 note of 500, 1 note of 100, 1 note of 50, 1 note of 20, 1 note of 10, 1 coin of 5, 1 coin of 2, 1 coin of 1. Total = 10 pieces.
4321	4×1000, 3×100, 2×10, 1×1	10	Player receives 4 notes of 1000, 3 notes of 100, 2 notes of 10, 1 coin of 1. Total = 10 pieces.

250	2×100, 1×50	3	Player receives 2 notes of 100, 1 note of 50. Total = 3 pieces.

Question Number 7 [10 Marks]:

Tony Stark was in his workshop, focused on five important coordinates displayed holographically. Time travel was their only hope to reverse the snap, so every number had to be exactly right.

Tony asked J.A.R.V.I.S. to check a new coordinate from an old S.H.I.E.L.D. file against these five stored values.

J.A.R.V.I.S. compared the new coordinate to each saved one in order. If a match was found, he reported it immediately; if not, he continued until all five were checked.

If no match appeared, J.A.R.V.I.S. informed Tony that the coordinate wasn't in the database.

You have 5 stored coordinates and 1 target coordinate; if found, output '1', otherwise output '0'. Can you help Tony find the correct coordinate?

Example:

Stored Coordinates (5 values)	Target Coordinate	Match Found?	Output
12, 45, 78, 23, 56	78	Yes	1
10, 20, 30, 40, 50	25	No	0
99, 88, 77, 66, 55	55	Yes	1
5, 15, 25, 35, 45	60	No	0

Question Number 8 [10 Marks]:

Hermione hurried to the enchanted lift, running late for Defence Against the Dark Arts. The lift announced its current floor and asked for her destination.

She replied, "Third floor, quickly please."

The lift's enchantment compares its current floor to the destination. If below the destination, it moves up one level; if above, it moves down one level. When it reaches the correct floor, it stops and opens the doors.

The lift smoothly passed the first and second floors and stopped at the third, announcing the Defence Against the Dark Arts corridor as the doors opened.

You need to create a flowchart showing how the lift decides to move based on the current and destination floors. The students rely on this enchantment working perfectly. Can you map Dumbledore's logic?

Current Floor	Destination Floor	Output Message
1	3	Arrived at floor 3; Doors open.
5	2	Arrived at floor 2; Doors open.
3	3	Already at floor 3; Doors open.
0	1	Arrived at floor 1; Doors open.
7	10	Arrived at floor 10; Doors open.
2	2	Already at floor 2; Doors open.

Question Number 9 [15 Marks]:

Spider-Man's Power Level Crisis

Peter Parker stood atop the Chrysler Building as dimensional rifts released dangerous versions of his old enemies. His AI, F.R.I.D.A.Y., warned him of the incoming threats and activated new suit upgrades tailored for each villain.

However, the sorting algorithm to prioritise these upgrades was offline. Peter had to manually arrange five power level readings from his suit's new abilities in descending order to deploy the strongest upgrades first.

Time was critical. Organise the five numbers from highest to lowest so Spider-Man can strategically face the multiverse villains. The fate of the multiverse depends on it. Can you help?

Example:

Input Power Levels (5 values)	Sorted (Descending Order)	Output Message
12, 45, 7, 30, 18	45, 30, 18, 12, 7	Strongest upgrades: 45, 30, 18, 12, 7.
99, 12, 55, 72, 40	99, 72, 55, 40, 12	Strongest upgrades: 99, 72, 55, 40, 12.

Question Number 10 [5 Marks]:

In *The Legend of Zelda*, Link is solving a puzzle where only **prime numbers** open the secret door.

The door asks him to enter the next **two prime numbers** after a number he chooses.

Task: Draw a flowchart that:

1. Takes a number N as input.
2. Finds the next **two prime numbers** greater than N.
3. Displays those prime numbers.

Rule: You cannot use a built-in "prime" check. You must figure out how to test for primality yourself.

Example:

Input N	Next Two Prime Numbers	Output Message
5	7, 11	Next two primes are 7 and 11.
10	11, 13	Next two primes are 11 and 13.
14	17, 19	Next two primes are 17 and 19.
20	23, 29	Next two primes are 23 and 29.
30	31, 37	Next two primes are 31 and 37.

Question Number 11 [10 Marks]:
Shape Validator and Calculator
Draw a flowchart that:

Takes the name of a shape from the user (Triangle, Square, Rectangle, or Circle).
Based on the selected shape, it takes the required measurements:

     a. **Triangle:** three sides
     b. **Square:** All 4 sides
     c. **Rectangle:** All four sides
     d. **Circle:** radius and circumference

It checks if it is valid, and if so, calculates and displays area and perimeter/circumference using formulas.
If invalid, display an error message and ask the user to re-enter measurements for the same shape.

Example:

Shape	Input Values	Valid ?	Area (approx π = 3.14)	Perimeter / Circumference	Output Message
Triangle	sides = 3, 4, 5	Yes	6	12	Area = 6, Perimeter = 12
Triangle	sides = 2, 2, 5	No	—	—	Invalid triangle, re-enter values
Square	side = 6	Yes	36	24	Area = 36, Perimeter = 24
Square	side = -4	No	—	—	Invalid side length, re-enter value

Question Number 12 [10 Marks]

Ethan Hunt's Troubles

In *Mission Impossible*, Ethan Hunt is given a secret numeric lock by the IMF. The lock will only open if the chosen code number passes a special test. To check it, Ethan must list all the smaller numbers that divide the code evenly and add them together. If the total exactly matches the original code, the lock opens successfully. If not, he gets another value from the IMF and repeats the process until he finds the correct answer.

Make a flowchart for Ethan so that he can code this and automate the process altogether.

Examples:

Code Number	Smaller Divisors	Sum of Divisors	Lock Opens?
6	1, 2, 3	6	Yes
12	1, 2, 3, 4, 6	16	No
28	1, 2, 4, 7, 14	28	Yes
15	1, 3, 5	9	No

Question Number 13 [10 Marks]

Sherlock's Hidden Sequence

London, a foggy evening. The clock at Baker Street struck eleven when Dr. Watson found Holmes sitting by the fire, staring at a half-burnt page.

On the page was a list of numbers scribbled hurriedly in pencil:

`3, 4, 8, 10, 15, 18, 24, 28, 35, …`

Watson raised an eyebrow. *"It looks random, Holmes. Perhaps just meaningless scribbles?"*

Holmes tapped his fingers impatiently. *"Nonsense, Watson. Nothing in this world is random. Every detail hides a design, especially when Moriarty is behind it."*

Holmes leaned closer. *"Observe. Do you not see it? Two different forces, like twin melodies, weave through the sequence. The trick is to separate them, then follow the pattern."*

Watson frowned, trying to make sense of the shifting numbers. Holmes continued:

"If you wish to walk in the footsteps of the great detective, you must prove it. Deconstruct the hidden law of these numbers. Once the pattern reveals itself, write it as a process, a machine of logic, step by step, decision by decision. A flowchart that, given several terms, recreates Moriarty's code."

Your Mission:

- Take the input n (number of terms).
- Reveal the secret rule hidden inside the numbers.
- Build a flowchart that generates the sequence correctly up to n terms.
- **Output:** The reconstructed sequence.

Holmes smiled faintly. *"Crack the pattern, Watson, and you crack Moriarty's code. Fail, and the trail goes cold."*

Example:

n	Reconstructed sequence (first n terms)	Output Message
1	3	Sequence (n=1): 3.
2	3, 4	Sequence (n=2): 3, 4.
3	3, 4, 8	Sequence (n=3): 3, 4, 8.
4	3, 4, 8, 10	Sequence (n=4): 3, 4, 8, 10.
5	3, 4, 8, 10, 15	Sequence (n=5): 3, 4, 8, 10, 15.

Question Number 14 [10 Marks]

Draw the flowchart of a program that evaluates the series

1 – 4 + 27 – 256 + 3000 – ... **up to *x* terms.**

where the value of *x* is taken as input from the user.

Example:

x	Series Expansion	Output
2	1 – 4	–3
3	1 – 4 + 27	24
4	1 – 4 + 27 – 256	–229

Question Number 15 [10 Marks]

Draw the flowchart of a program that evaluates the series

(2/1) – (4/3) + (6/5) – (8/7) + (10/9) – ... up to x terms,

where the value of x is taken as input from the user.

Examples:

- If x = 2 → (2/1) – (4/3) = 2 – 1.333... = 0.667 (approx.)
- If x = 3 → (2/1) – (4/3) + (6/5) = 2 – 1.333... + 1.2 = 1.867 (approx.)
- If x = 4 → (2/1) – (4/3) + (6/5) – (8/7) = 2 – 1.333... + 1.2 – 1.143... = 0.724 (approx.)

Question Number 16 [10 Marks]:

Bulbulay's Lucky Number

Momo, Nabeel, and their friends have received a secret numeric code from Khubsoorat's lottery system, and to unlock the jackpot, they need to find out how many times each digit appears in the code. Your task is to create a flowchart that takes a numeric code as input and calculates the frequency of each digit from 0 to 9 automatically, then outputs the counts of digits present in the number. Momo says, "If I can see how many times each digit repeats, maybe I'll finally win the lottery!" while Nabeel adds, "Let's make a flowchart so we don't have to count manually; life will be easier!"

Suddenly, Mehmood Sahab interrupts, **"Jo hamnay banana hai woh flowchart hai?"** and Momo whispers to Nabeel, **"Chuppay…"** before calling him Mustaqim, because he always messes things up.

Only digits present in the number need to be counted, and the order of digits in the output does not matter.

Example no.	Input	Output
1	1020304050	0 occurs 5 times,
		1 occurs 1 time
		2 occurs 1 time
		3 occurs 1 time
		4 occurs 1 time
		5 occurs 1 time
2	98766789	6 occurs 2 times
		7 occurs 2 times
		8 occurs 2 times
		9 occurs 2 times
3	5555555	5 occurs 7 times

Question Number 17 [10 Marks]

Write a flowchart that asks the user for a positive integer N. Using the formula.

$$F(x) = \frac{\left(\sin^3 x\right)\left(1 - \cos x\right)^2 \left(\sin 3x\right)^2 \left(\cos 2x - 1\right)^2}{\tan^2 x \left(\cos 2x - 1\right)^3 \left(\sin x - \sin 2x\right)^2} + \frac{\sec x}{\left(1 + \tan x\right)^2} + \cot^3 x \left(1 - \cos x\right)$$

generate the values of f(x) for x=1,2,3… Display each value one after the other until all N terms have been calculated. Use standard C++ operators to go about this problem.

Note: The trigonometric functions to be used are built in functions; you just need to do sin(x) to for the value of sin of variable x. Search up the internet for appropriate functions under the <cmath> library.

Question 18 [10 Marks]:

The Academic Performance Tracker

Ms. Rodriguez is a mathematics teacher who wants to create a visual representation of her students' test scores to help them understand their performance relative to their classmates. She needs a system that can display the scores as a bar chart using simple text characters.

"Visual feedback helps students grasp their performance better than just numbers," Ms. Rodriguez explained to the principal. "When they see their score represented graphically, it creates a stronger impact."

The grade visualisation system collects test scores from exactly 6 students, with each score rounded to the nearest 10 points for simplicity. The system then generates a horizontal bar chart where each asterisk symbol represents 10 points earned. Students can immediately see how their performance compares to others through the visual length of their respective bars.

The system begins by prompting for each student's score sequentially, storing the rounded values for chart generation. For each stored score, the program calculates the number of asterisks needed by dividing the score by 10, then displays the student number followed by the corresponding number of asterisk symbols. The visualisation continues until all 6 students have their scores represented in the bar chart format.

Example Output:

Enter score for Student 1: 85

Enter score for Student 2: 92

Enter score for Student 3: 78

Enter score for Student 4: 95

Enter score for Student 5: 88

Enter score for Student 6: 73

STUDENT PERFORMANCE CHART (Each * = 10 points)

Student 1: ********

Student 2: *********

Student 3: *******

Student 4: *********

Student 5: ********

Student 6: *******

Task: Create a flowchart showing how the system collects student scores and generates the bar chart.

Question Number 19 [15 Marks]:

Aura Police

You are a citizen of the LSP (Luigi Socialist Party) and work as a member of the Aura Police. Your responsibility is to calculate each citizen's social credits and determine whether they should receive a ration pack bonus or be exiled to Commie Land.

You have been given a series of steps to calculate their social credits and rank them on an Aura Scale.

- By virtue of being "Sentient Beings", each person starts with 500 Aura.
- If they are below 18, however, they receive a +500 Aura *(miner's bonus)*
- If they are under or equal to 60 and above or equal to 18, they receive +600 Aura (*unc bonus*).
- If they are older than 60, they receive +700 aura (*Gandalf aah bonus*).
- If they have a cat, they get +250 aura (*tryhards*)
- If they have a dog, they get +300 aura (*Scooby and Shaggy vibes fr*).

Still here? Have some more rules you need to take care of. (*Alexa, play sad music, please.*)
- Multiply the age they made their first Instagram Account by 50 and add it to their score, and if they haven't had an Instagram account in their life, give them +1000 aura (*Having a life bonus fr fr)*
- If they touch grass once a week, -100 aura. *(You are a CS Student and touch grass? Have some shame.)*
- Multiply their daily screentime by 100 and add it to their score. *(You gotta max-out doom scrolling if you have a life (or LeetCode and CodeForces challenges if you are a dweeb))*
- Finally, add your score to *the number of times you saw a first day at fast reel x 200*

Now, simply add up all the digits of your score.

- If it's greater than one digit, add up all the digits again and again until you reach one digit only.

The final digit is your penultimate Aura Score.

Now simply tell the score to the user.
- 7+ is **tryhard aurafarming.**
- 6-7 being the **sweet spot.**
- Below 6 means simply **get your funny up, not your money up**.

Question Number 20 [5 Marks]

Inside his lab, Tony Stark designs a new AI security system for his suits. The AI will only accept a number as a valid code if it can pass three challenges built into the program.

In the first challenge, the digits of the number are taken apart, and each digit's factorial value is calculated. If the sum of all these factorials matches the original number, the code passes this stage.

In the second challenge, the number is squared and then split into two parts. When these two parts are added together, the result must equal the original number to succeed.

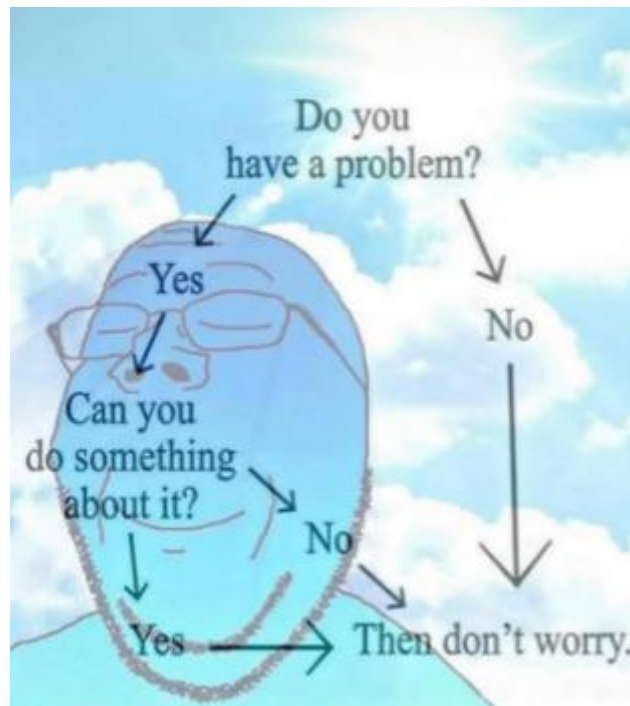In the third challenge, the code number must have at least one zero within it, though it cannot begin with zero.

Only numbers that satisfy all three challenges at once will be recognised by Stark's system as valid codes.

Example:

Code Number	Factorial Challenge (Sum of Digit Factorials)	Square-Split Challenge	Zero-Digit Challenge	Valid Code?	Output
297	2!+9!+7! not equal to 297 (Fail)	297^2 = 88209 → 88 + 209 = 297 (Pass)	Contains 0 (Pass)	No	Code Rejected
145	1!+4!+5! = 145 (Pass)	145^2 = 21025 → 210 + 25 = 235 (Fail)	No zero (Fail)	No	Code Rejected
?	Pass	Pass	Pass	Yes	Code Accepted

The bonus task is NOT to create a flowchart of this question *(if made, it wouldn't be credited),* **but rather to tell 5 values** (one value holds one mark each) **that passes this test.**

HAPPY FLOWCHARTING!

Above is just a meme - it's not an extra question. Don't try to solve this lads, the trauma actually ends here (at least for now)