

## COEP Satellite Team Induction Questionnaire

### ● February 2022 FY Coding Section

#### General Instructions:

1. Logical justification to answers is expected.
2. Answers should be submitted through <https://forms.gle/TnJrUUMhoUcEbJLWA>
3. Deadline for submission – 14<sup>th</sup> February 2022, 11.59 p.m.
4. It is NOT compulsory to answer all the questions. But attempting all questions would fetch you marks.
5. Use any source of information, but provide a reference and explanation at the end of the solution.
6. Attempt coding questions in C/C++ or Python programming language. Send us the solutions in separate .c, .cpp, .py or .txt file per question. Please send them in a single file(zip only).
7. The name of the zip file should follow the format “*mis\_firstname\_lastname.zip*”
8. Do not upload binary files.
9. Commenting and indenting your code properly is highly recommended.
10. If you are not able to produce a working code, a detailed description of the method or an algorithm along with pseudo code will fetch you marks.
11. Writing the solutions of Physics questions in a .txt file or image of the solved answer is acceptable.
12. Preferred branches: Computer, EnTC.
13. No CGPA criteria.
14. If you are preferring python as your programming language minimum use of inbuilt functions is recommended.
15. In case you have any doubts, please feel free to contact:  
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Q1. The Men In black have intercepted and decoded a suspicious alien message:  
"Earth is getting suspicious of our activities. Urgently contact code zero when the bases align next fastest."

On investigating further, it is found that the message came from a planetary system having two planets orbiting around their common center of mass, located in the galaxy far far away. In this planetary system planet, A has mass 25 times that of planet B. The rotation time is inversely proportional to the square root of their masses. The heavier planet has a new year every 10 days and completes an orbit in 5760 hrs. The planets have Major communication bases which can directly communicate only when both the bases and the center of mass are collinear.

After How much time the Men in black will intercept the next message?

One year = Time for the planet to orbit around the center of mass

One day = Time for the planet to rotate around itself once

Q2. At instant  $t = 0$ , a rod of mass  $m$ , length  $l$  is kept vertically on a completely frictionless surface and released.

- a) Describe the motion of the following points with respect to your frame of reference as well as with respect to the center of mass frame of reference:
  - i) Lowest point
  - ii) Center of mass
  - iii) Highest point
- b) Is the motion combined rotation and translation?
- c) Is there any movement of the lowest point in the vertical direction?
- d) Is the center of mass Frame inertial?

1. Given two arrays A and B in sorted order, create and print a third array C that contains all elements of both arrays in sorted order.

Example:

Input :

A: 1 2 3

B: 2 3 4 5

Output :

C: 1 2 3 4 5

2. For a given main string Str1 and a substring Str2, find how many times Str2 has appeared in Str1.

Example:

Input:

Str1: abcabc

Str2: abc

Output:

2

3. Compute the given function recursively till Nth (given as input) depth

$$\phi = 1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{1 + \dots}}}}}$$

Example:

Input:

N: 0

Output:

1

4. Write a program that takes an arbitrary number of integers as input, along with an integer 'k' and prints the kth smallest element of the sequence.

Example:

input:

numbers: 2 6 5 4 7 8 9 3 10 -5

k: 3

output:

3

5. Given a string as input, check whether it can be converted to a palindrome by rearrangement of characters. Print "Yes" if it is possible, else print "No".

Example:

Input:

aabcb

Output:

Yes

6. Given a list of points having integer coordinates. Consider the curve formed by joining the points in order by line segments. Remove all points, which if removed will yield the same curve.

Example:

Input:

(0, 0), (2, 2), (5, 5), (0, 5), (3, 2), (5, 0)

Output:

(0, 0), (5, 5), (0, 5), (5, 0)

7. A Satellite is revolving around the earth. Suddenly it encounters a problem and starts descending towards earth in a circular fashion. Its radius is decreasing after every revolution. The area in which it is revolving is divided into a form of a matrix. Print the path, the satellite traces before crashing.

Note: The starting point of the satellite is assumed to be the top left corner of the area matrix and it is revolving clockwise, also the matrix size can be variable.

Example:

Input :

```
1 2 3 4 5
6 7 8 9 10
11 12 13 14 15
16 17 18 19 20
21 22 23 24 25
```

Output:

```
1 2 3 4 5 10 15 20 25 24 23 22 21 16 11 6 7 8 9 14 19 18 17 12 13
```

8. Thanos has arrived on the Earth and he is hell-bent on wiping out the whole population. Assume that each being has a unique id given (unique id starts from 1 to n, if n is the total population). Thanos aligns all the people in line in increasing order of their unique ids and kills them iteratively. Every iteration, he makes those beings who are in odd-numbered positions disappear. Find the unique id of the person who is the last to disappear.

Example:

Input:

10

Output:

8

Explanation :

1 2 3 4 5 6 7 8 9 10

2 4 6 8 10

4 8

8

Thus the last person to survive has id 8.