COEP Satellite Team Induction Questionnaire

March 2022 SY Coding Section

General Instructions:

1. **Logical justification to answers is expected.**
2. **Answers should be submitted through**
   https://forms.gle/G7vhkzpcbhYscPSD8
3. **Deadline for submission – 14th March 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 reference and explanation at the end of the solution.**
6. **Attempt coding questions in C language only. Send us the solutions in separate .c files. Please send them in a single zip file.**
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. **In case you have any doubts, please feel free to contact:**
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Physics Section

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?
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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 lowest point in vertical direction ?
d) Is the center of mass Frame inertial?

Coding Section

1. Remove duplicates in a linked list.
   Example :
   Input :
   1 5 4 4 6 7 8 7
   Output :
   1 5 4 6 7 8

2. You are given strings A, B, and C as input. In string A, find all the occurrences of B and replace them with C till B does not appear in A.
Example:
Input:
A: “college of engineering pune"
B: “ege”
C: “xyz”
Output:
“collxyz of engineering pune”

3. You are given some money M, if you can buy each chocolate for N Rs and if K wrappers can buy you one chocolate, find the total number of chocolates one can buy with given money. Note that you cannot combine money with the wrapper.
Example
Input:
M: 10
N: 3
K: 3
Output:
4

4. Find and print all possible permutations of a string in which no two adjacent characters are the same.
Example :
Input:
aabb
Output:
abab, baba

5. Given the number of pairs of the parentheses as N, print all possible balance parentheses strings.
Example:
Input:
N = 2
Output:
(()), ()()

6. Given an array, find and print the longest Sub Array which is in AP.
Example :
Input :
5 6 7 8 12 7 9 0 -1 2 3 4 5 6
Output :
2 3 4 5 6

7. Bobby has rupees M and there are 3 items of rupees a, b and c respectively. Find the total number of combinations of items that can be bought such that he is left with rupees 0 exactly.
Example:
Input:
M = 5
a = 1
b = 2,
c = 3
Output:
(1, 1, 1, 1, 1), (3, 2), (3, 1, 1), (1, 2, 2), (1, 1, 1, 2)

8. Consider the granary having the stack of cement blocks with different heights lying next to each other, where the height of each block is one unit; The owner decided to use the space between the stacks to store the grains; determine how much amount of grain he can store without spilling. Consider that the amount of grain is measured in the units of a block.
(Input will be an array containing the height of each adjacent stack and output needs to be total amount of grain that can be stored in units of blocks)
example:
Input:
3, 0, 2, 0, 4
Output:
7
Explanation:
3 blocks between block with height 3 and 2.
1 block on top of block with height 2.
3 blocks between block with height 2 and 4.

9. Given N 32 bit signed integers, consider all possible pairs among the numbers and for each pair sum the count of different bit positions. The expected time complexity of the solution should be O(n).

Example :

Input:

1 3 5

Output :

4

Explanation :

Consider the binary representation of numbers

1 —> 001

3 —> 011

5 —> 101

Between the pairs (1, 3) and (1, 5) there is 1-bit difference each and for pairs (3, 5) there is a 2-bit difference.