Python assessment question

Difficulty: Easy

1 Given an array of integers nums and an integer target, return the indices of the two numbers such that they add up to target.

You may assume that each input would have **exactly one solution**, and you may not use the same element twice.

You can return the answer in any order.

Follow-Up:
Can you come up with an algorithm that is less than O(n2)O(n^2)O(n2) time complexity?

2 FizzBuzz

Write a program that outputs the string representation of numbers from `1` to `n`.
But for multiples of three, output "Fizz" instead of the number. For multiples of five, output "Buzz". For numbers that are multiples of both three and five, output "FizzBuzz".

Difficulty: Medium

3 Longest Substring Without Repeating Characters

Find the length of the longest substring without repeating characters in a string.

4 Given an integer array nums, return an array answer such that answer[i] is equal to the product of all elements of nums except nums[i].

Constraint: Solve it without using division and in O(n) time.

5 You are given an `m x n` grid where each cell can have one of three values:

- `0` representing an empty cell.
- `1` representing a fresh orange.
- `2` representing a rotten orange.

Every minute, any fresh orange that is adjacent (4-directionally) to a rotten orange becomes rotten. Return the minimum time required to rot all oranges. If it is impossible, return `-1`.

Difficulty : Hard

6 Trapping Rain Water

Given n non-negative integers representing the elevation map, calculate how much water it can trap after raining.

7 Minimum Window Substring

Given two strings s and t, return the minimum window in s which contains all characters of t.

8 You are given `n` jobs. Each job has a `startTime`, `endTime`, and a `profit`.
You need to schedule the jobs such that you maximize your total profit, ensuring that no two jobs overlap.

Return the maximum profit you can achieve.

Hint:

- Sort the jobs by their end time.
- Use binary search to find the latest non-overlapping job for efficient lookups.
- Use dynamic programming to store the maximum profit at each step

Median of Two Sorted Arrays

Given two sorted arrays nums1 and nums2 of size m and n, return the median of the two sorted arrays. The overall run time complexity should be $O(\log(\min(m,n)))$.

9. System Design interview question that focused on real-world applications and scalable architectures:

*** Design a Video Streaming Platform**

Develop a system similar to Netflix or YouTube.

Key areas to focus

- User recommendations based on watch history.
- Content delivery (e.g., adaptive streaming, CDN integration).
- Managing content libraries and subscriptions.
- Handling large-scale concurrency for live events.
- Implementing offline downloads.

***Design a Hotel Booking System**

Build a scalable system for booking hotel rooms, similar to Expedia or Booking.com.

Key Areas to Discuss:

- Room availability and dynamic pricing.
- Search and filter functionality based on user preferences.
- Payment processing and reservation confirmation.
- Managing bookings, cancellations, and modifications.
- Ratings and reviews for hotels and services.
- Scalability for multiple locations and languages.

***Objective:** Build a service like bit.ly that converts long URLs into short, unique ones and supports redirection.

Key Features:

1. **Shorten URLs:** Input a long URL and generate a unique short URL.
2. **Redirect URLs:** Use the short URL to redirect to the original URL.
3. **Scalability:** Handle billions of URLs and high traffic efficiently.

Key Considerations:

- Generate unique IDs (e.g., Base62, hashing, or random strings).
- Store mappings in a database with fast retrieval (e.g., key-value store).
- Use caching for frequently accessed URLs.
- Design for high availability, low latency, and scalability.

Discussion Points:

- Handle collisions in ID generation.
- Optional features like URL expiration or analytics.
- Strategies for scaling and monitoring the system.