Binary Search Practice Questions

🔠 1. Find the Longest Prefix with a Matching Word 🧬

📘 **Question:** You're given a sorted list of disease names. Write a function that finds the **longest prefix** of a given word that **exists in the list**.

🗒️ **Input:**

```
diseases = ["aids", "allergy", "anemia", "asthma", "autism"]
query = "autistic"
```

✅ **Output:** `"autism"`

🧠 **Hint:** Use binary search on prefixes by reducing the search window.

📖 2. Spell Suggestion in Medical Typing App 🩺

📘 **Question:** Given a sorted dictionary of valid medicine names, return the first word that starts with a given **prefix**.

🗒️ **Input:**

```
meds = ["acinil", "aspirin", "azithromycin", "benadryl", "cetirizine"]
prefix = "azi"
```

✅ **Output:** `"azithromycin"`

🧠 **Hint:** Modified binary search for first word with prefix.

⏳ 3. Minimum Time to Inject All Patients 💉

📘 **Question:** Each patient takes `t[i]` minutes to treat. You want to find the **minimum time** `x` in which you can treat all patients using at most `k` doctors, each working in parallel. Find `x` using binary search.

🗒️ **Input:**

`t = [2, 3, 4, 5], k = 2`

✅ **Output:** `7`

🧠 **Hint:** Apply binary search over time and simulate allocation.

🧪 4. Find First Faulty Vaccine Batch ID 💉

📘 **Question:** Vaccine batches are marked with version strings like `"v1.0"`, `"v1.1"`, ..., and sorted. At some point, all following batches are faulty. Find the **first faulty version**.

🗒️ **Input:**
`versions = ["v1.0", "v1.1", "v1.2", "v1.3", "v1.4"]`
Fault starts at: `"v1.3"`
✅ **Output:** `"v1.3"`

🧠 **Hint:** Use binary search to find the transition point.

🧬 5. Find K-th Smallest DNA Marker Length

📘 **Question:** You have `n` sorted DNA sequences (strings) of varying lengths. Find the **k-th smallest** string **length** across all of them.

🗒️ **Input:**
`lengths = [4, 5, 6, 7, 9]`, `k = 3`
✅ **Output:** `6`

🧠 **Hint:** Binary search on possible lengths.

🏥 6. Word Exists in Lexicographically Sorted Matrix

📘 **Question:** Given a 2D matrix of sorted drug names by row, check if a word exists.
Use binary search in **rows**, not whole matrix.

🗒️ **Input:**

```
drugs = [
  ["amox", "azith", "cefix"],
  ["doxy", "ibupro", "levo"],
  ["metro", "parace", "sulfa"]
]
target = "levo"
```

✅ **Output:** `True`

🧠 **Hint:** Binary search per row.

🔎 7. Find Closest Match in Health Symptoms DB

📘 **Question:** Given a sorted list of symptoms (strings), find the word with **smallest Levenshtein difference** to a query string.

🗒️ **Input:**
`symptoms = ["cough", "fever", "headache", "nausea", "rash"], query = "hedache"`
✅ **Output:** `"headache"`

🧠 **Hint:** Binary search with scoring could be hybridized here.

📈 8. Find Maximum Length of Common Prefix in Sorted Names

📘 **Question:** Given sorted patient names, find the maximum length of a common prefix between any two adjacent names.

🗒️ **Input:**
`names = ["Ankit", "Ankur", "Ansh", "Anya"]`
✅ **Output:** `3` (from "Ank")

🧠 **Hint:** Use binary search on prefix length between each pair.

📋 9. Book Title Auto Suggest for Medical Library 📚

📘 **Question:** Given a list of sorted book titles, return all titles starting with a prefix using efficient binary lookup.

🗒️ **Input:**
`titles = ["Antibiotics 101", "Asthma Care", "Cardiology", "Covid Protocols", "Diabetes Guide"]`
`prefix = "C"`
✅ **Output:** `["Cardiology", "Covid Protocols"]`

🧠 **Hint:** Use binary search for left and right bounds.

💾 10. Minimum Length Substring to Match All Symptoms

📘 **Question:** Given sorted list of symptoms as characters in a long string, find the smallest substring that contains **all unique symptoms**.

🗒️ **Input:**
`symptom_log = "hfhcnfhrhchfc"`
unique symptoms = `["c", "f", "h"]`
✅ **Output:** `"chf"`

🧠 **Hint:** Sliding window + binary search on window size.