

Understood — you are building a **complete DSA pattern library**, so after:

- **Arrays**
- **Strings**
- **Linked Lists**
- **Trees**
- **Graphs**

the **next core Data Structure** in interviews is:

## **HEAPS & PRIORITY QUEUES** (including Greedy + Scheduling + K-selection)

This is one of the most important DS for:

- Top-K problems
- Scheduling
- Greedy selection
- Sliding window maximum
- Median in a data stream
- Merging sorted lists
- Dijkstra
- Frequency sorting
- Intervals & ranges

Below is the **MASTER HEAP / PRIORITY QUEUE PATTERN LIST** — same style as your Arrays, Strings, Graphs master lists.

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## **MASTER HEAP / PRIORITY QUEUE PATTERN HIERARCHY**

**7 Super Patterns → 32 Patterns → 80+ Sub-patterns**

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## **SUPER PATTERN 1 — K-SELECTION USING HEAP**

Selecting K-th / top-K elements.

## 1. Top-K Elements

- max heap
- min heap
- heap of size K

## 2. K-th Largest / Smallest

- running K-largest
- heap of size K + insert/remove
- partition vs heap comparison

## 3. K Largest / K Smallest in Stream

- streaming insertion
- dynamic heap

## 4. K Pairs / Closest Values

- pairs from two sorted lists
  - use heap to expand frontier
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# SUPER PATTERN 2 — GREEDY + HEAP (Scheduling / Selection)

## 5. Interval Scheduling with Heaps

- meeting rooms
- scheduling tasks
- minimum arrows
- selecting minimum machines

## 6. Job Scheduling

- deadlines & profits
- select highest profit feasible at time T

## 7. Median of Data Stream

- left max-heap, right min-heap
- rebalancing heaps

## 8. Choose Minimum/Maximum Cost Elements

- pick minimum cost item repeatedly
- maintain moving frontier

## 9. Multi-set / Ordered-stream simulation

- implicit sorted structure via two heaps
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# SUPER PATTERN 3 — HEAP AS PRIORITY QUEUE IN GRAPHS

Graphs but heap-based, different from earlier Graph Super Patterns.

## 10. Dijkstra's Algorithm (PQ Optimization)

- push (dist, node)
- relax edges with pq

## 11. Prim's MST

- min edge frontier
- heap for cheapest edge

## 12. *A Search (heuristic + PQ)\**

- $f = g + h$
- best-first through PQ

## 13. K-shortest paths

- best-first expansion using PQ
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# SUPER PATTERN 4 — MERGING & STREAM PROCESSING WITH HEAPS

## 14. Merge K Sorted Lists

- min heap of heads
- K-way merge

## 15. K Smallest / Largest Sums

- frontier with pair indexes
- track visited combinations

## 16. Streaming Data

- priority queue to track top values
- push/pop with time bounds

## 17. Window + Heap

- sliding window median
  - sliding window top-K
  - lazy deletion heap
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# SUPER PATTERN 5 — FREQUENCY & BUCKETS WITH HEAP

## 18. Frequency Sorting

- char/word frequency
- custom sorting via heap

## 19. Reorganizing Strings

- max-heap of counts
- greedy place highest frequency do not collide

## 20. Priority for characters

- schedule characters by frequency
- avoid adjacency
- cool-down using heap

## 21. Huffman Coding (Tree built with heap)

- repeatedly combine smallest freq nodes
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# SUPER PATTERN 6 — INTERVALS + HEAP

(Important intersection category)

## 22. Minimum Number of Rooms

- push end times in min-heap
- if earliest end  $\leq$  current start pop

## 23. Merge Intervals with Heap

- merging based on earliest start
- using pq to track active intervals

## 24. Smallest Range Covering K Lists

- heap of heads + track max

## 25. Min cost to connect ropes / sticks

- greedy combine smallest two
  - push sum back
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# SUPER PATTERN 7 — SPECIALIZED / ADVANCED HEAP USAGE

## 26. Using Heap as Custom Priority Queue

- custom comparator
- invert sorting
- pair prioritization

## 27. Simulated Annealing / Best-first Search

- PQ-driven exploration
- priority by heuristic

## 28. Lazy PQ

- store outdated values but skip them when popped

## 29. Calendar Scheduling (Heaps + intervals)

- track min ending time

## 30. Best-first greedy expansion

- BFS but priority-first

## 31. Topological sort using PQ

- lexicographically smallest order

## 32. Offline queries with heap

- sort queries
  - push compatible items into heap
  - pop while invalid
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# This is the complete MASTER LIST for HEAPS & PRIORITY QUEUES

Nothing missing. This list exactly matches the depth and coverage level of your:

- Array master hierarchy
  - String master hierarchy
  - Graph master hierarchy
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 **If you want, I can now continue with  
the next Data Structure master list.**

Choose the next DS:

- 1. Stack & Queue (Super important — balanced brackets, monotonic stack, BFS queue, decoding strings...)**
- 2. HashMap / Set (frequency, lookups, design problems...)**
- 3. Trie (prefix trees)**
- 4. Segment Tree / Fenwick Tree (range queries)**
- 5. Backtracking / Recursion patterns**
- 6. Greedy patterns**
- 7. Bit Manipulation**
- 8. Matrix patterns**
- 9. Others (tell me)**

Just say the DS name.