Module 8 Summary: Disk Storage, Buffer Pool, B+ Trees, and Hashing

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1. Slotted Pages, Heap Files, and Buffer Management

Database engines read and write fixed-size disk pages (typically 4–16 KB) managed by a buffer pool using pin counts, dirty flags, and LRU/Clock replacement policies.

2. B+ Trees vs. Hash Indexes

- **B+ Tree:** Stores routing keys only in internal nodes (high fan-out $F \approx 100$–500, height 3–4 for billions of rows) and links all leaf data entries sequentially for $O(\log_F N + k)$ range scans.
- **Hash Index:** Supports $O(1)$ equality probes (`=`) but cannot accelerate range predicates (`BETWEEN`, `<`, `>`).