1. Asymptotic Notations:

- Big O: Worst case.
- Theta: Average case.
- Omega: Best case.

2. Divide and Conquer:

- Merge Sort: Split and merge sorted halves.
- Quick Sort: Partition around a pivot.

3. Greedy Algorithms:

- Local optimal leads to global optimal.
- Examples: Activity Selection, Huffman Coding, Kruskal's MST.

4. Dynamic Programming:

- Break problems into overlapping subproblems.
- Examples: Knapsack, LCS, Matrix Chain Multiplication.

5. Backtracking:

- Recursive trial and error.
- Examples: N-Queens, Sudoku Solver.

6. Branch and Bound:

- Prunes search tree based on bounds.
- Used in combinatorial optimization.

7. NP-Completeness:

- P: Solvable in polynomial time.
- NP: Verifiable in polynomial time.
- NP-Complete: Hardest in NP.
- NP-Hard: At least as hard as NP-Complete.

8. Useful Formulae:

- Time complexities:
  - Merge Sort: $T(n) = 2T(n/2) + O(n)$
  - Binary Search: $T(n) = T(n/2) + O(1)$

- Master Theorem (for divide & conquer): $T(n) = aT(n/b) + f(n)$
  - If $f(n) = O(n^{\log_b(a)})$, then $T(n) = \Theta(n^{\log_b(a)})$
  - Compare $f(n)$ with $n^{\log_b(a)}$ for decision