**CS600: Advanced Algorithms**

**Syllabus**

1. **Basic Data Structures**.
2. **Sorting**.
   * Bubble sort.
   * Insertion sort.
   * Merge sort.
   * Quick sort.
3. **Divide and Conquer**.
4. **Binary Trees**.
   * Binary tree.
   * K-d tree.
5. **Heaps**.
6. **Disjoint Sets**.
7. **Graph Basics**.
   * Graph data structures.
   * Shortest paths.
   * Minimum spanning trees.
8. **Network Flow Problems**.
   * Maximum flow problem.
   * Ford-Fulkerson algorithm and Edmonds–Karp algorithm.
   * Dinic's algorithm.
   * Max-flow and min-cut.
9. **Bipartite Graphs**.
   * Testing bipartiteness.
   * Maximum cardinality bipartite matching.
   * Maximum weight bipartite matching.
   * Stable marriage problem.
10. **Dynamic Programming**.
    * Fibonacci numbers.
    * Climbing stairs.
    * Longest common substring.
    * Edit distance.
    * Combinations of coins.
    * Knapsack.
    * All-pair shortest paths.
11. **Numerical Algorithms**.
    * Matrix multiplication.
    * Fast matrix multiplication.
    * Eigenvalue decomposition.
    * Least squares and gradient descent.
12. **Randomized Algorithms**.
    * Monte Carlo algorithms.
    * Concentration inequalities.
    * Pseudo random number generators.
    * Fingerprinting.
13. **Hashing**.
    * Hash table.
    * Collision-resistant hash.
    * Locality sensitive hashing.
14. **Cryptographic Algorithms**.
    * RSA algorithm.
15. **Blockchain**.