

## CS 6505 Course Syllabus

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1. Computability
  - a. Languages & Countability
  - b. Turing Machines
  - c. Models of Turing machines and computability
  - d. Church-Turing Thesis & Undecidability
  - e. Reducibility and other non-computable sets
  - f. Gödel Incompleteness Theorem
2. Complexity
  - a. The classes P and NP
  - b. Satisfiability and Cook-Levin
  - c. NP-Completeness Proofs
    - i. 3CNF-SAT
    - ii. Clique / Independent Set
    - iii. Vertex Cover
    - iv. Hamilton Cycle/Traveling Salesman
  - d. The P v NP problem and dealing with hardness
  - e. Space Complexity
3. Algorithms
  - a. FFT for polynomial multiplication
  - b. Dynamic Programming
    - i. Sequence Alignment
    - ii. Floyd-Warshall
  - c. Max-Flow/Min-cut
  - d. Bipartite Matching
  - e. Linear Programming
    - i. Basic Solutions
    - ii. Simplex Algorithm
  - f. Duality
    - i. Dual Forms
    - ii. MaxFlow/Mincut & Max-Matching/Vertex Cover Examples
  - g. Approximation Algorithms
    - i. Vertex Cover
    - ii. Metric TSP
  - h. Randomized Algorithms

- i. Karger's min-cut algorithm
- i. Beyond Single Core
  - i. Parallel and Quantum