Tutorial 3

Approximation and Online Algorithms

Submission Deadline - 13th September 2026

All problems marked (*) need to be submitted by the submission deadline.

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1. Give a 2-approximation algorithm for the Minimum Weight Vertex Cover problem using LP relaxation and deterministic rounding. Prove its approximation ratio. Also provide a tight example to establish the tightness of the approximation factor.

2. Give an f-approximation algorithm for the Set Cover problem (where each element belongs to at most f sets) using LP relaxation and deterministic rounding. Prove its approximation ratio. Also provide a tight example to establish the tightness of the approximation factor.

3. Give a 3-factor approximation algorithm for the Metric Uncapacitated Facility Location problem using LP relaxation and deterministic rounding. Prove its approximation guarantee. Also provide a tight example to establish the tightness of the approximation factor.

4. Give a 2-approximation algorithm for the Minimum Makespan on Unrelated Parallel Machines problem using a parametric LP relaxation and deterministic rounding. Prove its approximation ratio. Also provide a tight example to establish the tightness of the approximation factor.

5. (*) Give an Asymptotic Polynomial-Time Approximation Scheme (APTAS) for the Bin Packing problem using the configuration LP and deterministic rounding. Prove its approximation guarantee.