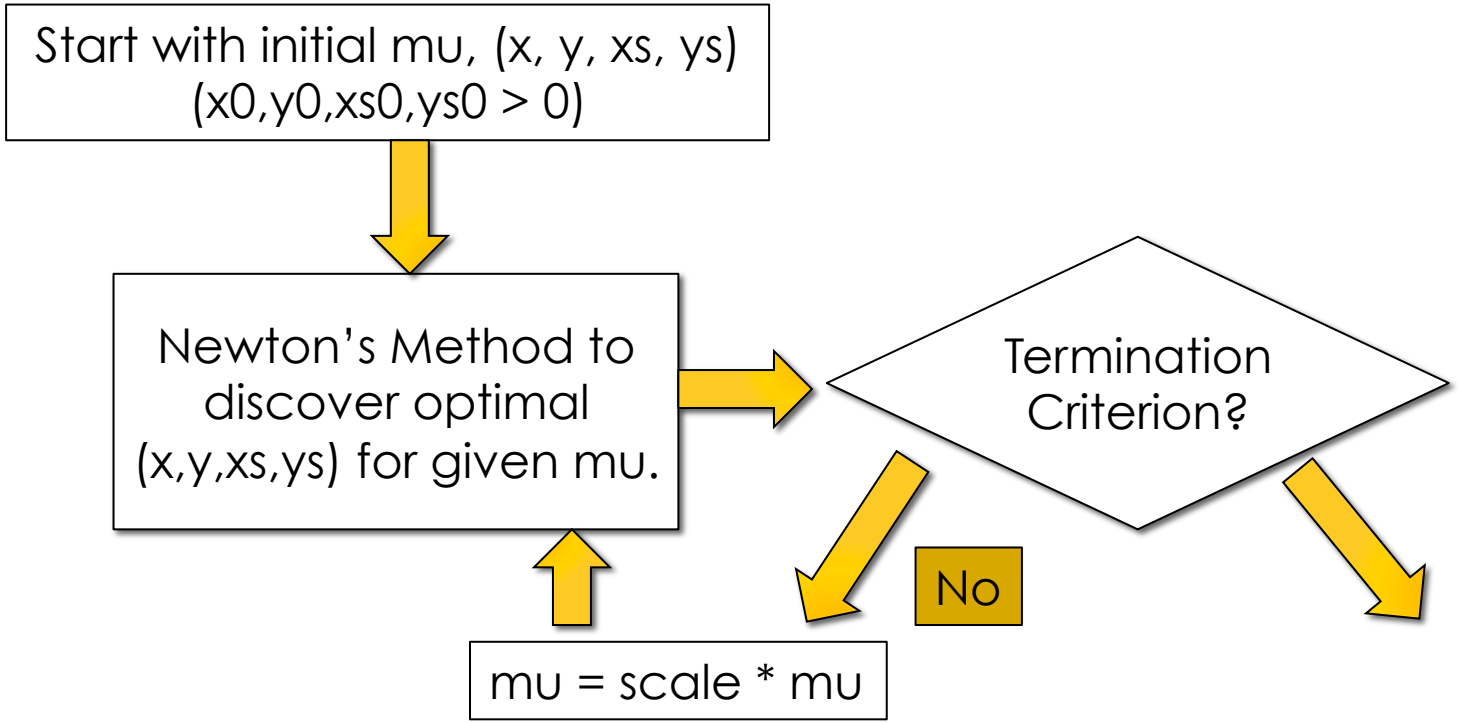
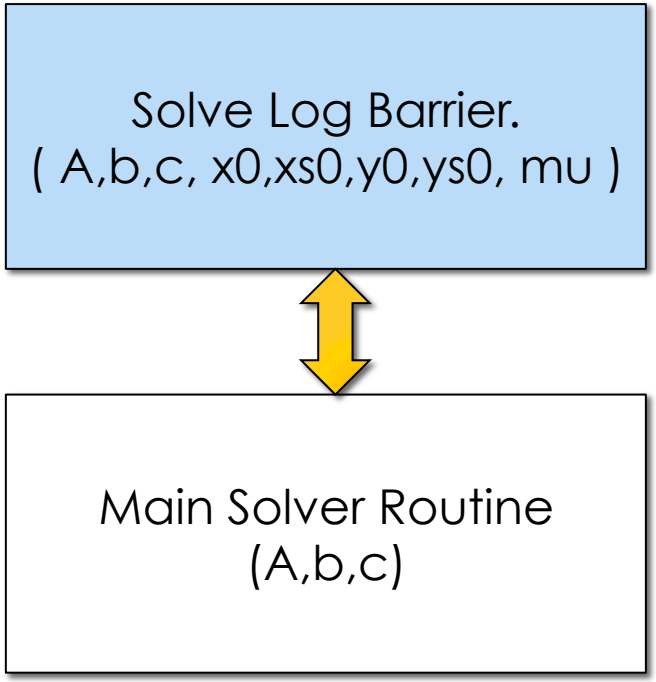
IMPLEMENTING A SIMPLE INTERIOR POINT SOLVER

Overall Algorithm



Implementation Details



Implement Newton's Method.

Solve to a tolerance or fixed number of iterations.

Implement Termination Criterion.

Analyze the solutions to determine final result.

Termination Criterion

- Primal-Dual Gap: $\mathbf{c}^\intercal \mathbf{x} - \mathbf{b}^\intercal \mathbf{y}$
- Primal Infeasibility Gap: $||A\mathbf{x} + \mathbf{x}_s - \mathbf{b}||$
- Dual Infeasibility Gap: $||A^\intercal \mathbf{y} - \mathbf{y}_s - \mathbf{c}||$
- Value of mu
- Change in solution across iterations.
- Iteration Limit.

Termination with Optimal Value

- The primal-dual gap, primal/dual infeasibilities converge to values less than a tolerance.

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Optimal solution found with objective value: 1406.699737
Number of iterations to converge: 30
Primal Feasibility Gap: 0.000000
Dual Feasibility Gap: 0.000000
Primal-Dual Gap: 0.000000
KKT-residual: 0.000000  (mu = 0.000000)
Number of Iterations: 30 (LIMIT: 30 )
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Termination with Primal Unbounded

Dual is infeasible, large values of primal may be seen.

- Primal infeasibility gap may converge to 0, but dual does not.
- Often, Hessian faces condition number issues.
  - Inverting Hessian leads to numerical instabilities.
- Primal-Dual gap does not converge to 0.