

(Equality constrained NLPs and algorithms for unconstrained NLP)

(100 points; Show all work to get full credit.)

Guidance for writing your assignment:

- a) make sure that your writing is legible and clear
- b) wherever appropriate, underline or rewrite the final answer
- c) clearly separate your work for subsequent questions
- d) submit your work on Canvas as one pdf file saved as <LastName_H#.pdf>, for example, <Smith_H1.pdf>

In problem 1 and 2 below, give theoretical arguments in support of the optimality of the solutions you found.

1. Problem 9.13 a page 337.

- (a) (5 points)** Write the KKT FONC to this NLP.
- (b) (10 points)** Find all solutions (\mathbf{x}, \mathbf{v}) to the KKT FONC for this NLP.
- (c) (10 points)** Find all optimal solutions to this NLP. Give their properties (choose from local, global, strict local, unique global).

2. Problem 9.13 c page 337.

- (a) (5 points)** Write the KKT FONC to this NLP.
- (b) (10 points)** Find all solutions (\mathbf{x}, \mathbf{v}) to the KKT FONC for this NLP.
- (c) (10 points)** Find all optimal solutions to this NLP. Give their properties (choose from local, global, strict local, unique global).

3. **(10 points)** Problem 9.45 page 342.

4.

- a) (10 points)** Find \mathbf{x}^1 for the unconstrained problem in question 3 above with the Newton Method.
- b) (3 points)** Compare the results you obtained with the steepest descent method and Newton method.
- c) (3 points)** Did you obtain an optimal solution? Explain.

5. **(24 points)** Problem 9.56 all, p. 344.