1 Problem

$$\min_x f(x)$$
$$g(x) \leq 0$$
$$h(x) = 0$$

2 Algorithm

Algorithm 1 Filter Line Search

1: **procedure** FILTER LINE SEARCH
2: *loop*:
3:     **while** True **do**
4:         $ineq \leftarrow m_g(x^k)$
5:         $active \leftarrow [i] : m_g(x^k)_i \geq -\tau$
6:         $c \leftarrow [m_h(x^k); m_g(x^k)_{active}]$
7:         $A \leftarrow [\nabla m_h(x^k); \nabla m_g(x^k)_{active}]$
8:         $G \leftarrow \nabla m_f(x^k)$
9:         $H \leftarrow \nabla^2 f(x^k)$
10:         $\theta \leftarrow \theta(x^k)$
11:         **if** check stopping criteria with model functions at x^k **then**
12:             **if** $r > \tau$ **then**
13:                 $r \leftarrow \gamma_{dec} r$
14:                 improve model
15:                 **continue**.
16:             return success
17:         $KKT \leftarrow [H, A^T; A, 0]$
18:         $rhs \leftarrow [G; c]$
19:         **if** $cond(KKT) > maxconidition$ **then**
20:             restore feasibility
21:             **continue**
22:         $[d; \_] = -KKT^{-1} rhs$
23:         $\alpha_{min} = $ compute minimum alpha
24:         $\alpha = 1$
25:         $accept = False$
26:         **while** $notaccept$ **do**
27:             $m \leftarrow \alpha G^T d$
28:             Variant: clip to trust region
29:             **if** $\alpha < \alpha_{min}$ **then**
30:                 restore feasibility
31:                 **goto** *loop*
32:             $x_{new} = x + \alpha * d$
33:             $\theta_{new} = \theta(x_{new})$
34:             $f_{new} = m_f(x_{n}ew)$
35:             **if** new inequality constraint becomes active **then**
36:                 $\alpha = \tau \alpha$
37:                 **continue**
38:             plot model
39:             **if** $[f_{n}ew, \theta_{new}]$ is dominated **then**
40:                 $\alpha = \tau \alpha$
41:                 **continue**
42:             $ftype \leftarrow m < 0 \wedge (-m)^{s_f} \alpha^{1-s_f} > \delta \theta^{s\theta}$
43:             **if** $ftype$ **then**
44:                 **if** $f_{new} \leq f + \eta_f m$ **then**
45:                     $accept \leftarrow True$
46:                 **else**
47:                     $\alpha = \tau \alpha$
48:                     **continue**
49:             **else**
50:                 check equation 8
51:             $\alpha = \tau \alpha$
52:         **if** $accept$ **then**
53:
54:             $rho \leftarrow$ compute rho
55:             **if** rho is small **then**
56:                 **if** $\|x_{n}ew - center\| < \frac{1}{2}$ **then**
57:                     $r \leftarrow \gamma_{dec} r$
58:                 **else**
59:                     $r \leftarrow \gamma_{inc} r$
60:                 improve the model
61:             **else if** rho is medium **then**
62:                 **if** lambda poised **then**
63:                     $r \leftarrow \gamma_{dec} r$
64:                 improve the model
65:             **else**continue
66:             **if** $(1 - \gamma_\theta) * \theta_{new} > tol$ **then** add to filter: $[f_{new} - \gamma_f \theta_{new}, (1 - constants.gamma_theta)\theta_{new}]$
67:             $x^{k+1} \leftarrow x_{new}$
68:             construct model functions m_f, m_h, m_g
69:         $i \leftarrow i + \max(delta_1(string(i)), delta_2(j))$.
70:     **goto** *top*.