

b)

$$\begin{aligned} \min_{u_{k+1}, \dots, u_{k+N}} & \sum_{j=k}^{k+N-1} x_j^T Q x_j + u_j^T R u_j + x_{k+N}^T P x_{k+N} \\ \text{s.t.} & x_{j+1} = A x_j + B u_j \quad j = k, \dots, k+N \\ & u_j \leq 1 \quad j = k, \dots, k+N \\ & -u_j \leq 1 \quad j = k, \dots, k+N \\ & x_{k+N}^T P x_{k+N} \leq c \\ & x_k = \bar{x} \end{aligned} \quad \left| \begin{array}{l} Q = I_2 \\ R = 1 \\ N = 3 \\ c = \frac{\lambda_{\min}(P)}{1.4} \\ u = (0.3, 1.4) \end{array} \right.$$

c) No results have to be filled in.

d)

$$\begin{aligned} z &= [x_k \dots x_{k+N} u_k \dots u_{k+N-1}]^T \\ H &= \begin{bmatrix} Q & \dots & 0 \\ & \ddots & \\ & & Q & P & R \\ & & & & R \end{bmatrix} \\ A_{ineq} &= \begin{bmatrix} & & I_{mN} \\ & & -I_{mN} \end{bmatrix} \\ B_{ineq} &= [1 \dots 1]^T \\ B_{eq} &= [x(k) \ 0 \dots 0]^T \\ A_{eq} &= \begin{bmatrix} I & 0 & \dots & 0 & C & \dots & 0 \\ A-I & 0 & \dots & 0 & B & \dots & 0 \\ & \ddots & & & & & \\ 0 & \dots & 0 & A-I & 0 & \dots & 0 \\ & & & & & & \\ & & & & & & \end{bmatrix} \\ T &= \begin{bmatrix} 0 & \dots & 0 & P & Q & \dots & 0 \end{bmatrix} \\ d &= c \end{aligned}$$

e) No results have to be filled in.

f) No results have to be filled in.

g) No results have to be filled in.