

# MEM 733 Applied Optimal Control 1

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## *Problem Set 1*

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1. Consider the system:

$$\begin{aligned}\dot{x}_1 &= x_2 \\ \dot{x}_2 &= u\end{aligned}$$

with fixed terminal time and cost function

$$J = x^T(t_f)x(t_f) + \int_0^{t_f} u^2 dt$$

and initial conditions  $x_1(0) = a, x_2(0) = b$ . What are the necessary conditions for a solution? Compute the trajectories for the case  $a = 1, b = 0$  with three different terminal times  $t_f = 1, 3, 5$ . Discuss the results.

2. Once again consider the system above. This time with free terminal time and cost function

$$J = x^T(t_f)x(t_f) + \int_0^{t_f} (1 + u^2) dt$$

Determine the necessary conditions and construct the solution, again with  $a = 1, b = 0$ . Discuss the results in comparison with problem 1.