

MATH3404 Assignment 3. Due on Friday, 10 October, 2014

1. (3 marks) Use the Weierstrass condition, find the (Strongly) minimizing curve and the value of  $J_{\min}$  for the cases

$$\int_1^2 (t^2 \dot{x}^2 + 2x^2) dt$$

where  $x(1) = 0$ ,  $x(2) = 7$ .

2. (4 marks) The system  $\dot{x} = x + u$ , where  $u = u(t)$  is not subject to any constraint, is to be controlled from  $x_1(0) = 3$  to  $x_1(t_1) = 2$  where  $t_1$  is unspecified, in such a way that

$$J = \int_0^{t_1} \left( x^2 + ux + \frac{1}{2}u^2 \right) dt$$

is minimized. Find the optimal control.

3. (3 marks) Solve the problem of time-optimal control to the origin for the system  $\dot{x}_1 = -3x_1 + x_2$  and  $\dot{x}_2 = x_1 - 3x_2 + u$  where  $|u| \leq 1$ .