

MATH 271 – Homework #11

due 16 April 2009

All computer calculations must be done in Matlab. These can be supplemented by work to be handed in on paper. For both these problems, use the matlab function `fmincon`. For information on this function, consult the tutorial page for the optimization toolbox and type `help fmincon` at the Matlab command prompt.

1) A small metal parts manufacturing company has decided to make use of the idle time of its equipment, so as to increase its profits. The company has determined that two particular parts (call them A and B) could be readily sold at a per unit profit of \$3 and \$2, respectively. So as not to overtax the machinery, the company decides to produce no more than 12 units of part A and no more than 10 units of part B per day. In order to manufacture part A , 5 minutes are required a lathe, 7 minutes on a mill, and 3 minutes on a grinder. In order to manufacture part B , 3 minutes are required a lathe, 5 minutes on a mill, and 7 minutes on a grinder. The company has available one machine of each type. The lathe is currently idle for 65 minutes per day; the mill is currently idle for 100 minutes per day; and the grinder is currently idle for 90 minutes per day. How many parts of type A and B should the company produce in order to maximize its profits? How much profit is made in this case?

2) The temperature distribution in a room is given by

$$T(x, y, z) = x^2y + 3xyz + 4y^2\sqrt{z},$$

where the room is defined by $0 \leq x \leq 20$, $0 \leq y \leq 20$, $0 \leq z \leq 8$. A spherical balloon of radius 2 is in the room, centered at the point $(3, 4, 5)$. Find the maximum and minimum temperatures on the surface of the balloon and at what points these extreme temperatures occur.