NATIONAL UNIVERSITY OF SINGAPORE
Department of Mathematics
Semester I (2006/2007) MA4260 Model Building in OR Tutorial (3)4

Q1. Consider the following nonlinear programming:

$$\begin{array}{ll} \text{Minimize} & \dfrac{0.5x_1 + 2.0x_2 - x_3}{2x_1 + 3x_2 + 5.0x_3} \\ \text{Subject to} & x_1 + x_2 + x_3 \geq 1 \\ & x_1, x_2, x_3 \geq 0. \end{array}$$

Reformulate the above nonlinear model into a linear programming model.

Q2. Suppose that x_1 and x_2 are two nonnegative continuous variables which cannot exceed 2. Use a $0-1$ variable δ to indicate whether or not the following constraint is satisfied

$$2x_1 + 3x_2 = 9.$$

Q3. Suppose that x_1 and x_2 are two nonnegative continuous variables which cannot exceed 3. Use a $0-1$ variable δ to indicate whether or not the following constraint is satisfied

$$2x_1 + 3x_2 \leq 12.$$

Q4. The CandidCam company manufactures three lines of cameras: the Cub, the Quickiematic and the VIP, whose contributions are \$9, \$27 and \$75 per unit, respectively. The distribution center requires that (i) at least 250 Cubs, 375 Quickimatics, and 150 VIPs should be produced each week and (ii) if the number of Cubs produced is more that 265 and the number of Quickiematics produced is more than 400 each week, then at least 165 VIPs should be produced each week.

Each camera requires a certain amount of time to: (i) manufacture the body parts; (ii) assemble the parts (lenses are purchased from outside sources and can be ignored in the production scheduling decision); and (iii) inspect, test, and package the final product. The Cub takes 0.1 hours to manufacture, 0.2 hours to assemble, and 0.1 hours to inspect, test and package. The Quickiematic takes 0.2 hours to manufacture, 0.35 hours to assemble, and 0.2 hours for the final set of operations. The VIP requires 0.7, 0.1, and 0.3 hours, respectively. In addition, there are 250 hours per week of manufacturing available, 350 hours of assembly, and 155 hours total to inspect, test and package.

Formulate this scheduling problem as a mathematical programming model that maximizes the total contribution.