NATIONAL UNIVERSITY OF SINGAPORE
Department of Mathematics
Semester 1 (2003/2004) MA4253 Mathematical Programming Tutorial 4

Q1. Solve the following problem by the Dantzig-Wolfe decomposition algorithm:

$$\begin{aligned} \min \quad & -4x_1 - 2x_2 - 6x_3 \\ \text{s.t.} \quad & 3x_1 + 2x_2 + 4x_3 = 34 \\ & 2 \le x_1 \le 4 \\ & 2 \le x_2 \le 4 \\ & 2 \le x_3 \le 4\,. \end{aligned}$$

Q2. Consider the linear program

$$\begin{aligned} \min \quad & -x_1 - x_2 \\ \text{s.t.} \quad & x_1 - x_2 + x_3 = 2 \\ & 4x_1 + 9x_2 \le 18 \\ & -2x_1 + 4x_2 \le 4 \\ & x_1, x_2, x_3 \ge 0\,. \end{aligned}$$

Treat the first constraint as the constraint set $Ax = b$ and the second and the third constraints as the set $Cx \ge d$. Form the Dantzig-Wolfe master program and solve it.

Q3. Consider the following linear programming

$$\begin{aligned} \min \quad & 10y_1 - 2y_2 + 4y_3 + 8y_4 + y_5 \\ \text{s.t.} \quad & y_1 - 4y_2 - y_3 \ge 8 \\ & 2y_1 - y_2 + y_3 \ge 2 \\ & 3y_1 + y_4 + y_5 \ge 4 \\ & y_1 + 2y_4 - y_5 \ge 10 \\ & y_1, y_2, y_3, y_4, y_5 \ge 0\,. \end{aligned}$$

(a) Solve the **DUAL** of the above problem using the Dantzig-Wolfe decomposition algorithm.
(b) Identify an optimal solution of the primal problem.