THE UNIVERSITY OF MELBOURNE

Student Number

Written assignment,

School of Mathematics and Statistics

MAST20018 Discrete Maths and Operations Research

This weekly assignment consists of 2 pages (including this page)

On the weekly assignments:

- All course assignments are individual activities. You can ask 'high-level' questions (i.e., no specific mention to answers) in #perusall.
- Assignments 2 - 9 will be scored using a 0 -10 scale.
- You all have 10 points for assignment 3.
- Extra points from Perusall (P) and Course Memory (CM) activities will be added to A and capped at 100: your final mark in the assignments component (worth 20% of the final mark) will be given by $\min(A + P + CM, 100)$
- **Full marks** will be given for answers that are correct and *concise but still comprehensive*. You will also be assessed based on the clarity and organisation of your submission, which includes correct use of notation.

- **Specific comments for this assignment:**

  Goal: The goal of this assignment is to increase and test your ability to convert linear programming models to their dual counterparts.

Question 1 (10 marks) Write the dual of the following linear programming models (Sierksma and Zwols).

(a)
$$\begin{aligned} \max \quad & x_1 + 2x_2 - 3x_3 \\ \text{s.t.} \quad & x_1 - 3x_2 \leq 7 \\ & 3x_1 + x_2 + 2x_3 \leq 6 \\ & -x_1 - 2x_2 - x_3 \geq -5 \\ & x_1, x_2, x_3 \geq 0. \end{aligned}$$

(b)
$$\begin{aligned} \min \quad & x_1 + x_2 \\ \text{s.t.} \quad & 2x_1 + 3x_2 + x_3 + x_4 \leq 0 \\ & -x_1 + x_2 + 2x_3 + x_4 = 6 \\ & 3x_1 + x_2 + 4x_3 + 2x_4 \geq 3 \\ & x_1 \leq 0,\ x_2, x_4 \geq 0,\ x_3 \text{ free}. \end{aligned}$$

(c)
$$\begin{aligned} \max \quad & 3x_1 - 5x_2 \\ \text{s.t.} \quad & 2x_1 - x_2 \geq 4 \\ & x_1 - x_2 \geq -3 \\ & 3x_1 - 2x_2 \leq 10 \\ & x_1, x_2 \geq 0. \end{aligned}$$

(d)
$$\begin{aligned} \max \quad & 5y_1 + 6y_2 + 3y_3 \\ \text{s.t.} \quad & -y_1 + 2y_2 \leq 1 \\ & 3y_1 - y_2 \geq 2 \\ & 3y_2 + y_3 = 3 \\ & y_1 \text{ free},\ y_2 \geq 0,\ y_3 \leq 0. \end{aligned}$$

End of Exam—Total Available Marks = 10