

MTH5114 Linear Programming and Game Theory, Spring 2024  
Week 8 Coursework Questions Viresh Patel

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These exercises should be completed individually and submitted (together with those of weeks 9 and 10) via the course QMPlus page by **9am on Tuesday, 09 April**.

Make sure you clearly write your **name** and **student ID** number at the top of your submission:.

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1. Give the dual of each of the following linear programs:

(a)                    maximize     $100x_1 + 200x_2 + 300x_3 + 400x_4$   
                          subject to         $x_1 + 2x_2 + 3x_3 - 4x_4 \leq 10,$   
    $-5x_1 - 6x_2 - 7x_3 + 8x_4 \geq -20,$   
    $9x_1 + 10x_2 + 11x_3 - 12x_4 = 30,$   
    $x_1, x_3 \geq 0,$   
    $x_4 \leq 0,$   
    $x_2$  unrestricted

(b)                    maximize     $x_4$   
                          subject to         $x_4 \leq x_1 - 2x_2 + 4x_3,$   
    $x_4 \leq -2x_1 + 3x_2 - 5x_3,$   
    $x_4 \leq 3x_1 - 4x_2 + 6x_3,$   
    $x_1 + x_2 + x_3 = 1,$   
    $x_1, x_2, x_3 \geq 0,$   
    $x_4$  unrestricted

**Hint:** Remember to first rewrite all the constraints so that all variables are on the left and the right-hand side is a constant.