

Decision 2 Linear Programming Questions

- 5 (a) Display the following linear programming problem in a Simplex tableau.

Maximise $P = 3x + 2y + 4z$

subject to
$$\begin{aligned} x + 4y + 2z &\leq 8 \\ 2x + 7y + 3z &\leq 21 \\ x \geq 0, y \geq 0, z &\geq 0 \end{aligned}$$

(3 marks)

- (b) Use the Simplex method to perform **one** iteration of your tableau for part (a), choosing a value in the z -column as pivot. *(3 marks)*
- (c) (i) Perform one further iteration. *(5 marks)*
- (ii) State whether or not this is the optimal solution, and give a reason for your answer. *(2 marks)*

- 5 A linear programming problem involving variables x and y is to be solved. The objective function to be maximised is $P = 4x + 9y$. The initial Simplex tableau is given below.

P	x	y	r	s	t	<i>value</i>
1	-4	-9	0	0	0	0
0	3	7	1	0	0	33
0	1	2	0	1	0	10
0	2	7	0	0	1	26

- (a) Write down the **three** inequalities in x and y represented by this tableau. *(2 marks)*
- (b) The Simplex method is to be used to solve this linear programming problem by initially choosing a value in the x -column as the pivot.
- (i) Explain why the initial pivot has value 1. *(2 marks)*
- (ii) Perform **two** iterations using the Simplex method. *(7 marks)*
- (iii) Comment on how you know that the optimum solution has been achieved and state your final values of P , x and y . *(3 marks)*

- 3 (a) Display the following linear programming problem in a Simplex tableau.

$$\begin{array}{ll}
 \text{Maximise} & P = 5x + 8y + 7z \\
 \text{subject to} & 3x + 2y + z \leq 12 \\
 & 2x + 4y + 5z \leq 16 \\
 & x \geq 0, y \geq 0, z \geq 0
 \end{array}
 \quad (3 \text{ marks})$$

- (b) The Simplex method is to be used by initially choosing a value in the y -column as a pivot.
- (i) Explain why the initial pivot is 4. (1 mark)
- (ii) Perform **two** iterations of your tableau from part (a) using the Simplex method. (6 marks)
- (iii) State the values of P , x , y and z after your second iteration. (2 marks)
- (iv) State, giving a reason, whether the maximum value of P has been achieved. (1 mark)

- 4 A linear programming problem involving variables x and y is to be solved. The objective function to be maximised is $P = 3x + 5y$. The initial Simplex tableau is given below.

P	x	y	s	t	u	$value$
1	-3	-5	0	0	0	0
0	1	2	1	0	0	36
0	1	1	0	1	0	20
0	4	1	0	0	1	39

- (a) In addition to $x \geq 0$, $y \geq 0$, write down **three** inequalities involving x and y for this problem. (2 marks)
- (b) (i) By choosing the first pivot from the **y -column**, perform **one** iteration of the Simplex method. (4 marks)
- (ii) Explain how you know that the optimal value has not been reached. (1 mark)
- (c) (i) Perform one further iteration. (4 marks)
- (ii) Interpret the final tableau and state the values of the slack variables. (3 marks)