

ASSIGNMENT 2

CSCI 4113/6101

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DUE: OCT 21, 2025, 11:59PM

This assignment focuses on using the Simplex Algorithm to solve linear programs. You will be working with the following LP:

$$\begin{aligned} &\text{Minimize } -4x - y + 3z \\ &\text{s.t. } -8x - 5y + 3z \geq -10 \\ &\quad -7x - 4y + 2z \leq 20 \\ &\quad 3x + y - z = 4 \\ &\quad x \geq 0 \\ &\quad y \leq 0 \end{aligned} \tag{1}$$

QUESTION 1: CANONICAL FORM

Transform the above LP into canonical form. Detail the steps you took to obtain this LP (e.g., negate objective function, negate constraints, split unconstrained variables into two non-negative variables, etc.)

QUESTION 2: STANDARD FORM

Continue your journey. Take the LP in canonical form you obtained in Question 1 and transform it into standard form.

QUESTION 3: TABLEAU

Express the LP from Question 2 in tableau form. List the corresponding basic solution. Is this solution feasible? Justify your answer.

QUESTION 4: SIMPLEX INITIALIZATION

Transform the tableau from Question 3 into an equivalent one whose basic solution is feasible. This transformation should consist of constructing an auxiliary LP, finding an optimal solution of this auxiliary LP using the Simplex Algorithm, and then dropping the auxiliary variable and restoring the original objective function. List the steps you take (e.g., introduce auxiliary variable, pivot (including which variable leaves the basis and which one enters), restore objective function. etc.) and show the tableau you obtain after each step.

QUESTION 5: SIMPLEX OPTIMIZATION

Use the Simplex Algorithm to find an optimal solution of the LP you obtained in Question 4. Present the steps of your solution as in Question 4. List the solution of (1) that corresponds to the BFS of the final tableau you obtain.

MARKING SCHEME

QUESTION 1 (8 MARKS)

	Yes	Minor mistakes	Major mistakes	No
Provided LP is equivalent to given LP	2 marks	1 mark	0.5 marks	0 marks
Provided LP is in canonical form	2 marks	1 mark	0.5 marks	0 marks
Steps to achieve the transformation are clearly stated	4 marks	2 marks	1 mark	0 marks

QUESTION 2 (4 MARKS)

	Yes	Minor mistakes	Major mistakes	No
Provided LP is equivalent to LP in Question 1	2 marks	1 mark	0.5 marks	0 marks
Provided LP is in standard form	2 marks	1 mark	0.5 marks	0 marks

QUESTION 3 (5 MARKS)

	Yes	Minor mistakes	Major mistakes	No
Tableau represents LP in Question 2	2 marks	1 mark	0.5 marks	0 marks
Provided solution is the basic solution of the tableau	1 mark			0 marks
Basic solution is correctly characterized as feasible or infeasible	1 mark			0 marks
Correct argument why this basic solution is feasible or not	1 mark			0 marks

QUESTION 4 (10 MARKS)

	Yes	Minor mistakes	Major mistakes	No
Correct auxiliary LP	2 marks	1 mark	0.5 marks	0 marks
Correct steps to obtain a tableau whose BFS is an optimal solution of the auxiliary LP, tableau after each step shown	2 marks	1 mark	0.5 marks	0 marks
Steps taken to transform tableau in each step listed	2 marks	1 mark	0.5 marks	0 marks
BFS of final tableau is optimal solution of auxiliary LP	2 marks	1 mark	0.5 marks	0 marks
Correct transformation of final tableau equivalent to auxiliary LP into tableau equivalent to original tableau and with a BFS	2 marks	1 mark	0.5 marks	0 marks

QUESTION 5 (8 MARKS)

	Yes	Minor mistakes	Major mistakes	No
Correct steps to obtain tableau whose BFS is an optimal solution, tableau after each step shown	2 marks	1 mark	0.5 marks	0 marks
Steps taken to transform tableau in each step listed	2 marks	1 mark	0.5 marks	0 marks
BFS of final tableau is optimal solution	2 marks	1 mark	0.5 marks	0 marks
Correct solution of (1) derived from final tableau	2 marks	1 mark	0.5 marks	0 marks

SUBMISSION INSTRUCTIONS

Follow the submission link for this assignment on the course webpage in the email you should have received from Crowdmark. Upload the assignment as a single PDF file.