

QQQ – Decision 1 – Chapter 7 – The Simplex Algorithm (Version 1)

Total Marks: 24

(24 = Platinum, 22 = Gold, 19 = Silver, 16 = Bronze)

1. The tableau below is the initial tableau for a linear programming problem in x , y and z . The objective is to maximise the profit, P .

Basic variable	x	y	z	r	s	t	Value
r	2	-4	1	1	0	0	15
s	4	2	-8	0	1	0	20
t	1	-1	4	0	0	1	8
P	-3	2	7	0	0	0	0

- (a) Perform one iteration of the Simplex algorithm to obtain a new tableau, T. State the row operations you use. (5)
- (b) Write down the profit equation given by T and state the current values of the slack variables. (2)

(Total 7 marks)

2. A maximisation linear programming problem in x , y and z is to be solved using the two-stage simplex method.

The partially completed initial tableau is shown below.

Basic variable	x	y	z	s_1	s_2	s_3	a_1	a_2	Value
s_1	1	2	3	1	0	0	0	0	45
a_1	3	2	0	0	-1	0	1	0	9
a_2	-1	0	4	0	0	-1	0	1	4
P	-2	-1	-3	0	0	0	0	0	0
A									

- (a) Using the information in the above tableau, formulate the linear programming problem. State the objective and list the constraints as inequalities. (4)
- (b) Complete the bottom row of Table 1 in the answer book. You should make your method and working clear. (2)

[Table 1 in the answer book is a copy of the partially completed initial tableau above.]

The following tableau is obtained after two iterations of the first stage of the two-stage simplex method.

Basic variable	x	y	z	s_1	s_2	s_3	a_1	a_2	Value
s_1	0	$\frac{5}{6}$	0	1	$\frac{7}{12}$	$\frac{3}{4}$	$-\frac{7}{12}$	$-\frac{3}{4}$	$\frac{147}{4}$
x	1	$\frac{2}{3}$	0	0	$-\frac{1}{3}$	0	$\frac{1}{3}$	0	3
z	0	$\frac{1}{6}$	1	0	$-\frac{1}{12}$	$-\frac{1}{4}$	$\frac{1}{12}$	$\frac{1}{4}$	$\frac{7}{4}$
P	0	$\frac{5}{6}$	0	0	$-\frac{11}{12}$	$-\frac{3}{4}$	$\frac{11}{12}$	$\frac{3}{4}$	$\frac{45}{4}$
A	0	0	0	0	0	0	1	1	0

- (c) (i) Explain how the above tableau shows that a basic feasible solution has been found for the original linear programming problem.
- (ii) Write down the basic feasible solution for the second stage. (3)
- (d) Taking the most negative number in the profit row to indicate the pivot column, perform one complete iteration of the second stage of the two-stage simplex method, to obtain a new

tableau, T . Make your method clear by stating the row operations you use. **(5)**

(e) (i) Explain, using T , whether or not an optimal solution to the original linear programming problem has been found.

(ii) Write down the value of the objective function.

(iii) State the values of the basic variables. **(3)**

(Total 17 marks)