CLASS TEST MEMO

Decision Support Systems I (North-West University)

MEMO Class test 2 (11:00) 19/04/2022

QUESTION 1/VRAAG 1

Consider the following linear programming model:

Beskou die volgende lineêre programmeringsmodel:

$$Maximise\ Z = 3x_1 + 9x_2$$
$$subject\ to:$$
$$2x_1 + 8x_2 = 48$$
$$2x_1 + 4x_2 \leq 32$$
$$x_2 \geq 2$$
$$x_1, x_2 \geq 0$$

1.1. Convert the constraints to equalities by adding the appropriate variables.

1.1. Skakel die beperkings om na gelykhede deur die toepaslike veranderlikes by te voeg. (8)

$$2x_1 + 8x_2 + 0S_1 + 0S_2 + 1A_1 + 0A_2 = 48$$
$$2x_1 + 4x_2 + 1S_1 + 0S_2 + 0A_1 + 0A_2 = 32$$
$$0x_1 + x_2 + 0S_1 - 1S_2 + 0A_1 + 1A_2 = 2$$
$$x_1, x_2, S_1, S_2, A_1, A_2 \geq 0$$

1.2. Add the new variables (in question 1.1) into the objective function with the appropriate coefficients.

1.2. Voeg die nuwe veranderlikes (in vraag 1.1) by die doelfunksie met die toepaslike koëffisiënte. (4)

$$Maximise\ Z = 3x_1 + 9x_2 + 0S_1 + 0S_2 - MA_1 - MA_2$$

QUESTION 2/VRAAG 2

Consider the first tableau of a linear programming model below:

Beskou die eerste tableau van 'n lineêre programmeringsmodel onder:

2.1. Copy the tableau and complete the missing values.

2.1. Skryf die tableau oor en voltooi die ontbrekende waardes. (9)

C_j →		50	60	0	0	M	M	
	Solution mix	x_1	x_2	S_1	S_2	A_1	A_2	**Quantity**
M	A_1	20	40	-1	0	1	0	80
M	A_2	30	20	0	-1	0	1	60
	Z_j	$50M$	$60M$	$-M$	$-M$	M	M	$140M$
	$C_j - Z_j$	$50 - 50M$	$60 - 60M$	M	M	0	0	

2.2. Which variable will enter the basis next?

2.2. Watter veranderlike sal die basis volgende inkom? (1)

x_2

2.3. Which variable will leave the basis next?

2.3. Watter veranderlike sal die basis volgende verlaat? (1)

A_1

2.4. Solve the problem using the simplex method. Please use fractional notation (e.g. ½) in the case of non-integers.

2.4. Los die probleem op met behulp van die simpleksmetode. Gebruik asseblief fraksionele notasie (bv. ½) in geval van breuke. (17)

C_j		50	60	0	0	M	M	
	Solution mix	x_1	x_2	S_1	S_2	A_1	A_2	**Quantity**
60	x_2	$\frac{1}{2}$	1	$-\frac{1}{40}$	0	$\frac{1}{40}$	0	2
M	A_2	20	0	$\frac{1}{2}$	-1	$-\frac{1}{2}$	1	20
	Z_j	$30+20M$	60	$-\frac{3}{2}+\frac{1}{2}M$	$-M$	$\frac{3}{2}-\frac{1}{2}M$	M	$120+20M$
	$C_j - Z_j$	$20-20M$	0	$\frac{3}{2}-\frac{1}{2}M$	M	$-\frac{3}{2}+\frac{3}{2}M$	0	

C_j		50	60	0	0	M	M	
	Solution mix	x_1	x_2	S_1	S_2	A_1	A_2	**Quantity**
60	x_2	0	1	$-\frac{3}{80}$	$\frac{1}{40}$	$\frac{3}{80}$	$-\frac{1}{40}$	$\frac{3}{2}$
50	x_1	1	0	$\frac{1}{40}$	$-\frac{1}{20}$	$-\frac{1}{40}$	$\frac{1}{20}$	1
	Z_j	50	60	-1	-1	0	0	140
	$C_j - Z_j$	0	0	1	1	$M-1$	$M-1$	

Final solution: $x_1 = 1, x_2 = \frac{3}{2}, Z = 140$

TOTAL/TOTAAL: 40

File reference: 8.1.7.2.2