

MODUL 5 - LINEAR PROGRAMMING METODE SIMPLEX

Ex 1. $\max Z = 3x_1 + 4x_2$

s.t (1) $2x_1 + x_2 \leq 6000$

(2) $2x_1 + 3x_2 \leq 9000$

(3) $x_1, x_2 \geq 0$

Langkah 1. Ubah ke bentuk standar

$$\begin{array}{ll} \text{fx tujuan} & Z - 3x_1 - 4x_2 = 0 \\ \text{s.t (1)} & 2x_1 + x_2 + s_1 = 6000 \\ \text{s.t (2)} & 2x_1 + 3x_2 + s_2 = 9000 \end{array}$$

Langkah 2. Susun ke dalam tabel

V.D	Z	x_1	x_2	s_1	s_2	N.K
Z	1	-3	-4	0	0	0
s_1	0	2	1	1	0	6000
s_2	0	2	3	0	1	9000

Langkah 3. Pilih kolom dg nilai negatif terbesar
di baris Z

\Rightarrow Kolom x_2

T1	V.D	Z	x_1	x_2	s_1	s_2	N.K
Z	1	-3	-4	0	0	0	0
s_1	0	2	1	1	0	6000	6000
s_2	0	2	3	0	1	9000	9000
T2	V.D	Z	x_1	x_2	s_1	s_2	N.K
Z	1	$-\frac{1}{3}$	0	0	$\frac{9}{3}$	$-\frac{1}{3}$	12000
s_1	0	$\frac{4}{3}$	0	1	$-\frac{1}{3}$	3000	3000
x_2	0	$\frac{2}{3}$	1	0	$\frac{1}{3}$	3000	3000
T3	V.D	Z	x_1	x_2	s_1	s_2	N.K
Z	1	0	0	$\frac{1}{4}$	$\frac{5}{4}$	12750	12750
x_1	0	1	0	$\frac{3}{4}$	$-\frac{1}{4}$	2250	2250
x_2	0	0	1	$-\frac{1}{2}$	$\frac{1}{2}$	1500	1500

$$Z = 12750$$

$$x_1 = 2250$$

$$x_2 = 1500$$

$$Z = 3x_1 + 4x_2$$

$$= 3(2250) + 4(1500)$$

$$= 6750 + 6000 = 12750$$

Langkah 4. Hitung ratio dari NK / kolom terpilih

$$S_1 = \frac{6000}{1} = 6000$$

$$S_2 = \frac{9000}{3} = 3000$$

Pilih baris dengan ratio terkecil

\Rightarrow Baris S_2

Langkah 5. Ganti kolom terpilih ($L+3$) dgn

baris terpilih ($L+4$)

\checkmark Nilai pivot = 1

\checkmark Nilai lain selain pivot $\Rightarrow 0$

V.D	Z	X_1	X_2	S_1	S_2	N.K
Z	1	-3	-4	0	0	0
S_1	0	2	1	1	0	6000
S_2	0	2	3	0	1	9000

↑ nilai pivot

$$\begin{array}{rcl} S_1 \text{ lm } & 0 & 2 \\ X_2 \text{ Br } & 0 & \frac{2}{3} \end{array} \quad \begin{array}{rcl} 1 & 1 & 0 \\ 0 & 1 & 0 \end{array} \quad \begin{array}{rcl} 6000 \\ 3000 \end{array}$$

$$S_1 \text{ Br } \quad 0 \quad \frac{4}{3} \quad 0 \quad 1 - \frac{1}{3} \quad 3000$$

V.D	Z	X_1	X_2	S_1	S_2	N.K
Z	1	$-\frac{1}{3}$	0	0	$\frac{4}{3}$	12000
S_1	0	$\frac{4}{3}$	0	1	$-\frac{1}{3}$	3000
X_2	0	$\frac{2}{3}$	1	0	$\frac{1}{3}$	3000

$$\begin{array}{rcl} Z \text{ lm } & 1 & -3 & -4 & 0 & 0 & 0 \\ 4X_2 \text{ Br } & 0 & \frac{8}{3} & 4 & 0 & \frac{4}{3} & 12000 \end{array} \quad +$$

$$Z \text{ Br } \quad 1 \quad -\frac{1}{3} \quad 0 \quad 0 \quad \frac{4}{3} \quad 12000$$

Langkah 6. Ulangi Langkah 3 sd Langkah 5

ungga nilai di Baris Z bernilai positif
semua.

	V.D	Z	X_1	X_2	S_1	S_2	N.K
out	Z	1	$-\frac{1}{3}$	0	0	$\frac{9}{3}$	12000
T2	S_1	0	$\frac{4}{3}$	0	1	$-\frac{1}{3}$	3000
	X_2	0	$\frac{2}{3}$	1	0	$\frac{1}{3}$	3000

$$\text{Ratio} \quad S_1 = \frac{3000}{\frac{9}{3}} = 9000/3 = 2250$$

$$X_2 = \frac{3000}{\frac{2}{3}} = 9000/2 = 4500$$

	V.D	Z	X_1	X_2	S_1	S_2	N.K
T3	Z	1	0	0	$\frac{1}{4}$	$\frac{5}{4}$	12750
	X_1	0	1	0	$\frac{3}{4}$	$-\frac{1}{4}$	2250
	X_2	0	0	1	$-\frac{1}{2}$	$\frac{1}{2}$	1500

$$-\frac{3}{4} = 0$$

Z_{LM}	1	$-\frac{1}{3}$	0	0	$\frac{9}{3}$	12000
X_{BR}	0	$\frac{4}{3}$	0	$\frac{1}{4}$	$-\frac{1}{2}$	750
Z_{BR}	1	0	0	$\frac{1}{4}$	$\frac{5}{4}$	12750

X_{2LM}	0	$\frac{4}{3}$	1	0	$\frac{9}{3}$	3000
X_{BR}	0	$\frac{2}{3}$	0	$\frac{1}{2}$	$-\frac{1}{6}$	1500
X_{1BR}	0	0	1	$-\frac{1}{2}$	$\frac{1}{2}$	1500

Bentuk tidak standar (Batasan masalah = atau \geq)

$$\text{Ex 2. } \min Z = 5x_1 + 2x_2$$

$$\text{st (1)} \quad 2x_1 + x_2 = 6000$$

$$\text{(2)} \quad 2x_1 + 3x_2 \geq 9000$$

$$\text{(3)} \quad x_1 + x_2 \leq 4000$$

$$(4) \quad x_1, x_2 \geq 0$$

Ubah ke Bentuk standar

$$\min Z = 5x_1 + 2x_2$$

$$x(-1) \quad \max -Z = -5x_1 - 2x_2$$

$$-Z + 5x_1 + 2x_2 = 0$$

$$\text{st (1)} \quad 2x_1 + x_2 = 6000$$

$$\Rightarrow 2x_1 + x_2 + R_1 = 6000$$

$$\text{st (2)} \quad 2x_1 + 3x_2 \geq 9000$$

$$2x_1 + 3x_2 + R_2 - S_2 = 9000$$

$$\text{st (3)} \quad x_1 + x_2 \leq 4000$$

$$x_1 + x_2 + S_3 = 4000$$

$$\begin{array}{rcl} -Z + 5x_1 + 2x_2 + MR_1 + MR_2 & = & 0 \\ \text{st (1)} \quad 2x_1 + x_2 + R_1 & = & 6000 \\ \text{st (2)} \quad 2x_1 + 3x_2 + R_2 - S_2 & = & 9000 \\ \text{st (3)} \quad x_1 + x_2 + S_3 & = & 4000 \end{array}$$

	Z	x_1	x_2	R_1	R_2	S_2	S_3	NK
Z	-1	5	2	M	M	0	0	0
R_1	0	2	1	1	0	0	0	6000
R_2	0	2	3	0	1	-1	0	9000
S_3	0	1	1	0	0	0	1	4000

$$Z_{BR} = Z_{UM} - M(R_1) - M(R_2)$$

$$Z_{UM} \leq 2M \quad M \quad M \quad 0 \quad 0 \quad 0$$

$$M(R_1) \geq 2M \quad M \quad M \quad 0 \quad 0 \quad 0 \quad 6000M$$

$$\underline{\underline{5-2M \quad 2-M \quad 0 \quad M \quad 0 \quad 0 \quad -6000M}}$$

$$M(R_2) \leq 2M \quad 3M \quad 0 \quad M \quad -M \quad 0 \quad 9000M$$

$$\underline{\underline{5-4M \quad 2-4M \quad 0 \quad 0 \quad M \quad 0 \quad -15000M}}$$

Tabel awal

VD	Z	X_1	X_2	R_1	R_2	S_2	S_3	NK
Z	-1	5	2	M	M	0	0	0
R_1	0	2	1	1	0	0	0	6000
R_2	0	2	3	0	1	-1	0	9000
S_3	0	1	1	0	0	0	1	4000

Tabel awal setelah Revisi Baris Z

VD	Z	X_1	X_2	R_1	R_2	S_2	S_3	NK
Z	$5-4M$	$2-4M$	0	0	M	0	-15000M	
R_1	2	1	1	0	0	0	0	6000
R_2	2	3	0	1	-1	0	9000	
S_3	1	1	0	0	0	1	4000	

Q : Manakah Minus terbesar, $5-4M$ atau $2-4M$
A : Asumsi: $M=100$

$$5-4(100)$$

$$2-4(100)$$

$$5-400$$

$$2-400$$

$$= -395$$

$$= -398$$

Lanjutan Lihat di modul 5.19

Lihat Tabel 5.18 dr modul 5 (S.19)

Z	0	0	$(-3+M)$	0	$(\frac{1}{3} + \frac{1}{6}M)$	1	-14000
X_1	1	0	1	0	0	0	2000
X_2	0	1	-1	0	0	2	2000
S_3	0	0	-1	1	-3	4	1000

Analisis Sensitivitas Untuk Batasan #1

V.D	Z	X ₁	X ₂	S ₁	S ₂	N.K
Z	1	0	0	1/4	5/4	12750
X ₁	0	1	0	3/4	-1/4	2250
X ₂	0	0	1	-1/2	1/2	1500

V.D	NK(Lama)	S ₁	NK Baru > 0
Z	12750	1/4	12750 + 1/4 A ₁
X ₁	2250	3/4	2250 + 3/4 A ₁
X ₂	1500	-1/2	1500 - 1/2 A ₁

$$(1) 2250 + \frac{3}{4} A_1 \geq 0$$

$$\frac{3}{4} A_1 \geq -2250$$

$$A_1 \geq -2250 \cdot \frac{4}{3}$$

$$A_1 \geq -750 \cdot 4$$

$$A_1 \geq -3000$$

$$(2) 1500 + (-\frac{1}{2} A_1) \geq 0$$

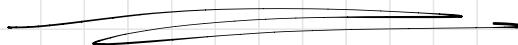
$$1500 - \frac{1}{2} A_1 \geq 0$$

$$-\frac{1}{2} A_1 \geq -1500$$

$$-A_1 \geq -3000$$

$$A_1 \leq 3000$$

$$-3000 \leq A_1 \leq 3000$$



$$\text{Ex 1. } \max Z = 3x_1 + 4x_2$$

$$\text{s.t. (1) } 2x_1 + x_2 \leq 6000 + \Delta_1 \rightarrow -3000 \leq \Delta_1 \leq 3000$$

$$(2) 2x_1 + 3x_2 \leq 9000 + \Delta_2 \rightarrow -3000 \leq \Delta_2 \leq 9000$$

$$(3) x_1, x_2 \geq 0$$

Analisis Sensitivitas Untuk Batasan #2

V.D	Z	x_1	x_2	S_1	S_2	N.K
Z	1	0	0	$\frac{1}{4}$	$\frac{5}{4}$	12750
x_1	0	1	0	$\frac{3}{4}$	$-\frac{1}{4}$	2250
x_2	0	0	1	$-\frac{1}{2}$	$\frac{1}{2}$	1500

V.D	NK (Lama)	S_2	NK Baru ≥ 0
Z	12750	$\frac{5}{4}$	$12750 + \frac{5}{4}\Delta_2$
x_1	2250	$-\frac{1}{4}$	$2250 + (-\frac{1}{4})\Delta_2$
x_2	1500	$\frac{1}{2}$	$1500 + \frac{1}{2}\Delta_2$

$$(1) 2250 - \frac{1}{4}\Delta_2 \geq 0$$

$$-\frac{1}{4}\Delta_2 \geq -2250$$

$$\frac{1}{4}\Delta_2 \leq 2250$$

$$\Delta_2 \leq 9000$$

$$(2) 1500 + \frac{1}{2}\Delta_2 \geq 0$$

$$\frac{1}{2}\Delta_2 \geq -1500$$

$$\Delta_2 \geq -3000$$

$$-3000 \leq \Delta_2 \leq 9000$$