

Recall NASA dietary requirements problem:

Minimize: $W = 3A + 2B$

Subject to:

$$4A + 3B \geq 42$$

negate $\rightarrow$

$$W - 3A - 2B = 0 \rightarrow \begin{cases} -W + 3A + 2B = 0 \end{cases}$$

$$2A + 6B \geq 30$$

"

$\rightarrow$

$$-2A - 6B \leq -30$$

$\rightarrow$

$$\begin{cases} -4A - 3B + u = -42 \\ -2A - 6B + v = -30 \\ -2A - B + w = -18 \end{cases}$$

$$2A + B \geq 18$$

"

$\rightarrow$

$$-2A - B \leq -18$$

$$\begin{cases} -2A - B + w = -18 \end{cases}$$

$$A \geq 0, B \geq 0$$

	A	B	u	v	w	W	
u	-4	-3	1	0	0	0	-42
v	-2	-6	0	1	0	0	-30
w	-2	-1	0	0	1	0	-18
W	3	2	0	0	0	-1	0

③ Ratios

① $-42/-3 = 14$

② $-30/-6 = 5 \leftarrow$

③ $-18/-1 = 18$

Pivot here

	A	B	u	v	w	W	
u	-1	0	1	-1/2	0	0	-27
B	1/3	1	0	-1/6	0	0	5
w	-5/3	0	0	-1/6	1	0	-13
W	7/3	0	0	1/3	0	-1	-10

③ Ratios

① $-27/-3 = 9$

② $5/(1/3) = 15$

③ $-13/(-5/3) = \frac{-13}{1} \times \frac{-3}{5} = \frac{39}{5} < 8$

Pivot

$$\begin{array}{c} u \\ B \\ A \\ W \end{array} \left[\begin{array}{cccc|ccc} 0 & 0 & 1 & -1/5 & -9/5 & 0 & -18/5 \\ 0 & 1 & 0 & -1/5 & 1/5 & 0 & 12/5 \\ 1 & 0 & 0 & 1/10 & -3/5 & 0 & 39/5 \\ 0 & 0 & 0 & 1/10 & 7/5 & -1 & -141/5 \end{array} \right] \leftarrow \text{pivot!}$$

(2)

Ratios: $\frac{18}{9} \times \frac{8}{9} = 2$

$\frac{12}{5} \times \frac{8}{9} = \frac{96}{45} = \frac{32}{15}$

$$\frac{12/5}{1/5} = 12$$

$$\frac{39/5}{-3/5} = -13$$

$$\begin{array}{c} u \\ B \\ A \\ W \end{array} \left[\begin{array}{cc|cc|cc|c} A & B & u & v & w & W & \text{Ratios} \\ 0 & 0 & -5/9 & 1/9 & 1 & 0 & 18 \leftarrow \\ 0 & 1 & 1/9 & -2/9 & 0 & 0 & 2 \\ 1 & 0 & -1/3 & 1/6 & 0 & 0 & 9 \\ 0 & 0 & 7/9 & -1/18 & 0 & -1 & -31 \end{array} \right]$$

18 ←
-ve
54

$$\begin{array}{c} \rightarrow v \\ \rightarrow B \\ \rightarrow A \\ \rightarrow W \end{array} \left[\begin{array}{cccc|ccc} 0 & 0 & -5 & 1 & 9 & 0 & 18 \\ 0 & 1 & -1 & 0 & 2 & 0 & 6 \\ 1 & 0 & 1/2 & 0 & -3/2 & 0 & 6 \\ 0 & 0 & 1/2 & 0 & 1/2 & -1 & -30 \end{array} \right]$$

All +ve!

$u=18 \leftarrow$ Exceed,

$B=6 \checkmark$

$$A=6 \quad \checkmark$$

$$\sim N \approx -30 \Rightarrow N \approx 30 \quad \checkmark$$