Transportation

1) North west corner (Stepping stone)
2) Row Minima
3) Column Minima
4) Lowest cost entry
5) VAM (Vogel's Approximation Method)

	W_1	W_2	W_3	W_4	Capacity
F_1	5(19)	2(30)	50	10	7/2/0
F_2	70	6(30)	3(40)	60	9/3/0
F_3	40	8	4(70)	14(20)	18/12/4
requirement	5/0	8/6/0	7/4/0	14	34

6(6)/0

min(5, 7)

1) $5X19 + 2X30 + 6X30 + 3X40 + 4X70 + 14X20$

$= 1015$

$\leq 7X10 + 8X30 + 1X40 + 5X40 + 6X70 + 7X20$

$= 1110$

low mining

2)

19	30	50	7(10)	7/0 ← Ans
70	8(30)	1(40)	60	9/1/0 ←
5(40)	8	6(70)	14(20)	18/11/6/0
5 →	8/0 ↑	7	14	7/0

Lowest cost entry

~~19~~	~~30~~	~~50~~	7(10)	7/0
2(70)	30	7(40)	60	9/2
3(40)	8(8)	~~70~~	7(20)	18/10/3/0
5/2/0	8/0	7/0	14/7/0	

$\Rightarrow 7\times10 + 5\times40 + 7\times40 + 8\times8 + 7\times20$

$= 70 + 200 +$

19	30	50	7(10)	7/0
2(70)	30	7(40)	60	9/2/0
3(40)	8(8)	70	7(20)	18/10/3/0
5/2/0	8/0	7/0	14/7/0	

$\Rightarrow \min(8) = \checkmark$

$\Rightarrow$ $\min(10) = \checkmark$
$\min(19) = \times$
$\min(20) = \checkmark$
$\min(30) = \times$
$\min(30) = \times$
$\min(40) = \checkmark$
$\min(40) = \checkmark$
$(50) = \times$

$\Rightarrow 2\times70 + 7\times10 + 7\times40 + 3\times40 + 8\times8 + 7\times20$

$=$

VAM (Vogel's Approximation Method)

					Penalty
19	~~30~~	50	10	7	19-10 = 9
70	30	~~40~~	60	9	40-30 = 10
~~40~~	8(8)	~~70~~	20	18/10	20-8 = 12
5	8/0	7	14		
Penalty	21	23	10	10	

~~50~~	~~7~~(10)	2/0	40
40	60	9	20
7	4		
10	50 ↑		

⇒ Largest penalty

			Capacity					
~~5~~ (19)	50	10	~~7~~/2	9	~~7~~(10)	~~9~~(60)	~~9~~/7	20
~~70~~	40	60	9	20	7	40/2		
~~40~~	70	20	10	20	40	60		
5/0	7	14						

2 ↑	10	10		
	50	10	2	40
	40	60	9	20
	~~70~~	10(20)	10	50 ←
	7	14/4		
	10	10		

$3x_1 + 2x_2$

$3(3) + 2(1) = 11$

objective

↓

max $Z = 3x_1 + 2x_2 + 0x_3 + 0x_4$

Simplex.

min $Z = 3x_1 + 2x_2$

$\max Z = -3x_1 - 2x_2$

$x_1 + x_2 \leq 4$

$x_1 - x_2 \leq 2$

$x_1, x_2 \geq 0$

$x_1 + x_2 + x_3 + 0x_4 = 4$

$x_1 - x_2 + 0x_3 + x_4 = 2$

C_B	X_B	C_j	3	2	0	0	min ratio
			x_1	x_2	x_3	x_4	
0	x_3	4	1	1	1	0	$4/1 = 4$
0	x_4	2	1	−1	0	1	$2/1 = 2$ ←
		$Z_j - C_j$	−3	−2	0	0	

↑ entering variable

$(\sum C_B X_j) - C_j$

$(0 + 0) - 3$

$= -3$

B/x_j

B/x_4

$R_1 \rightarrow R_1 - R_2$

$4 - 2 = 2$

$1 - 1 = 0$

$1 - (-1) = 2$

$1 - 0 = 1$

$0 - 1 = -1$

	C_B	X_B	B	3 x_1	2 x_2	0 x_3	0 x_4	min ratio
	0	x_3	2	0	2 (key)	1	-1	$2/2 = 1$
	3	x_1	2	1	-1	0	1	$\frac{2}{-1} = -2$
	Z_j			3	-5	0	3	
	$C_j - Z_j$			0	7 (entering)			

$(0 \times 0 + 3 \times 1) - 3$

$3 - 3$

$(0 \times 2 + (-3)) - 2$

$-3 - 2$

C_B ↓

Z_j ↓

$R_1 \rightarrow \frac{R_1}{2}$

	C_B	X_B	B	3 x_1	2 x_2	0 x_3	0 x_4
	2	x_2	1	0	1	1/2	1/2
	3	x_1	2	1	0	1/2	-1/2
	$Z_j - C_j$		3	0	0	1/2	1/2

$R_2 \rightarrow R_2 + R_1$

$2 + 1 = 3$

$1 + 0 = 1$

$-1 + 1 = 0$

$0 + \frac{1}{2} = \frac{1}{2}$

$1 - \frac{1}{2} = \frac{1}{2}$