Tableau 5.23

9	3	6	7	3	100
0	(60)	0	0	(40)	
7	5	2	10	6	160
(50)	0	(80)	0	(30)	
5	4	9	8	10	100
(0)	0	0	(100)	0	
50	60	80	100	70	

Supply

Demand

w_1 w_2 w_3 w_4 w_5

Tableau 5.23

v_1 9	3	6	7	3	100
0	(60)	0	0	(40)	
v_2 7	5	2	10	6	160
(50)	0	(80)	0	(30)	
v_3 5	4	9	8	10	100
(0)	0	0	(100)	0	
50	60	80	100	70	

Supply (m)

Demand (n)

$(m+n-1)$ basic variables

$3+5-1=7$.

$$\begin{cases} v_1+w_2=3 \\ v_1+w_5=3 \\ v_2+w_1=7 \\ v_2+w_3=2 \\ v_2+w_5=6 \\ v_3+w_1=5 \\ v_3+w_4=8 \end{cases} \Rightarrow \begin{array}{l} v_2=0 \\ w_1=7 \\ w_3=2 \\ w_5=6 \\ v_1=3-6=-3 \\ w_2=3-(-3)=6 \\ v_3=5-7=-2 \\ w_4=8-(-2)=10 \end{array} \Rightarrow$$

x_{11}: $v_1+w_1-c_{11}=-3+7-9=-5$

x_{13}: $v_1+w_3-c_{13}=-3+2-6=-7$

x_{14}: $v_1+w_4-c_{14}=-3+10-7=0$

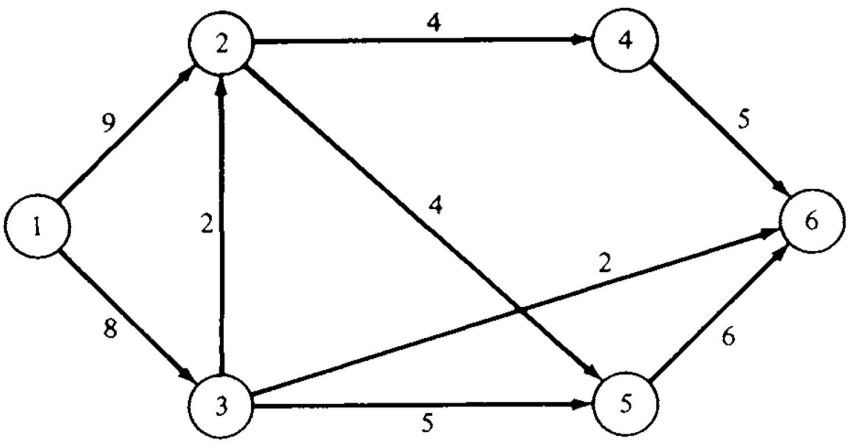
(x_{22}): $v_2+w_2-c_{22}=0+6-5=1$

x_{24}: $v_2+w_4-c_{24}=0+10-10=0$

x_{32}: $v_3+w_2-c_{32}=-2+6-4=0$

x_{33}: $v_3+w_3-c_{33}=-2+2-9=-9$

x_{35}: $v_3+w_5-c_{35}=-2+6-10=-6$



(9, 1)

(4, 2)

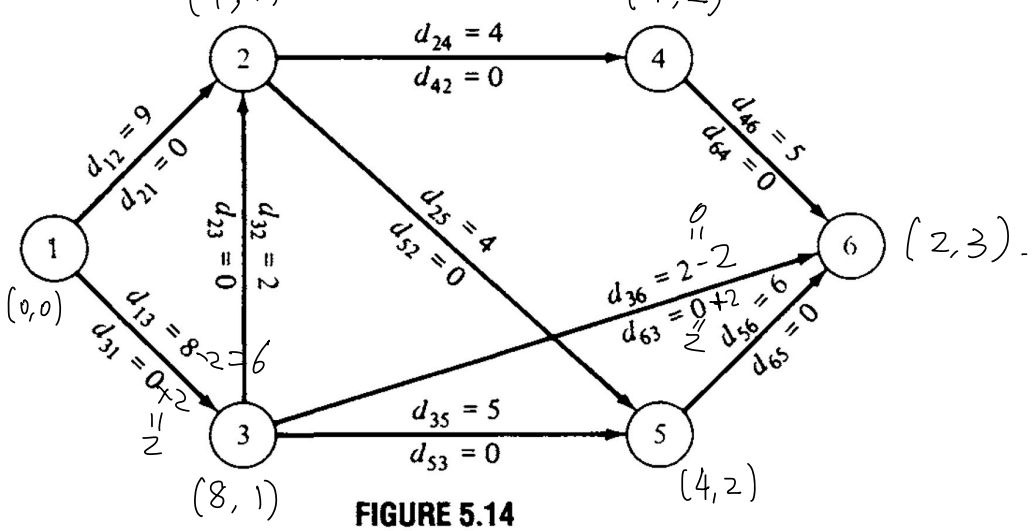


FIGURE 5.14

In[1]:=
```
TObj[A_, B_, IA_] := Module[{M1, m, n, M, b, i, j, S},
m = Dimensions[A][[1]]; n = Dimensions[A][[2]];
M1 = Table[0, m, n];
S = M1;
M = Table[0, m + n - 1, m + n];
b = Table[0, m + n - 1];
For[i = 1, i ≤ m + n - 1, i++, M[[i, B[[i, 1]]]] = 1;
    M[[i, m + B[[i, 2]]]] = 1;
    b[[i]] = Extract[A, B[[i]]]; (*A[[B[[i]][[1]],B[[i]][[2]]]*)];
V = LinearSolve[M, b];
For[i = 1, i ≤ m, i++,
For[j = 1, j ≤ n, j++,
If[MemberQ[B, {i, j}], M1[[i, j]] = bp;
      S[[i, j]] = IA[[Flatten[Position[B, {i, j}]][[1]]]],
M1[[i, j]] = V[[i]] + V[[m + j]] - A[[i, j]];
]
]
];
{M1 // MatrixForm, S // MatrixForm}]



TPivot[Lp_, Bp_, Ia_, Mv_] := Module[{ll, lpp, elia, pma, ma, Bp2, Ia2, Tc},
ll = Length[Lp];
lpp = Flatten[Table[Position[Bp, Lp[[i]]], {i, 2, Length[Lp]}]]; (*Position in of LP(i) in BP*)
elia = Table[Ia[[ lpp[[2 i - 1]] ]], {i, 1, ll / 2}];
  (*removing the entering var, extract the odd position amount*)
pma = PositionSmallest[elia][[1]];
  (*find the position of smallest amount which is the departing var*)
ma = Min[elia]; (*the smallest amount*)
Bp2 = ReplaceAll[Bp, Lp[[2 * pma]] → Lp[[1]] ;
  (*replacing the even departing position by the entering position*)
lpp = Join[lpp, Position[Bp, Lp[[2 * pma]]][[1]]];
Ia2 = Ia;
For[i = 1, i ≤ ll / 2, i++,
Ia2[[lpp[[2 i - 1]]]] = Ia[[lpp[[2 i - 1]]]] - ma;
Ia2[[lpp[[2 i]]]] = Ia2[[lpp[[2 i]]]] + ma;
];
Tc = Sum[Extract[Mv, Bp2[[i]]] * Ia2[[i]], {i, 1, Length[Ia2]}];
{Bp2, Ia2, Tc}
]
```

In[3]:=
```
CM = {{9, 3, 6, 7, 3}, {7, 5, 2, 10, 6}, {5, 4, 9, 8, 10}};
T1a = {{{1, 2}, {1, 5}, {2, 1}, {2, 3}, {2, 5}, {3, 1}, {3, 4}},
{60, 40, 50, 80, 30, 0, 100}};
T1 = Join[T1a, {Sum[Extract[CM, T1a[[1]][[i]]] * T1a[[2]][[i]], {i, 1, Length[T1a[[2]]}]}]
TObj[CM, T1[[1]], T1[[2]]]
```

Out[5]= {{{1, 2}, {1, 5}, {2, 1}, {2, 3}, {2, 5}, {3, 1}, {3, 4}}, {60, 40, 50, 80, 30, 0, 100}, 1790}

Out[6]= $$\left\{\begin{pmatrix} -5 & bp & -7 & 0 & bp \\ bp & 1 & bp & 0 & bp \\ bp & 0 & -9 & bp & -6 \end{pmatrix}, \begin{pmatrix} 0 & 60 & 0 & 0 & 40 \\ 50 & 0 & 80 & 0 & 30 \\ 0 & 0 & 0 & 100 & 0 \end{pmatrix}\right\}$$

In[7]:=
```
T2 = TPivot[{{2, 2}, {2, 5}, {1, 5}, {1, 2}}, T1[[1]], T1[[2]], CM]
TObj[CM, T2[[1]], T2[[2]]]
```

Out[7]= {{{1, 2}, {1, 5}, {2, 1}, {2, 3}, {2, 2}, {3, 1}, {3, 4}}, {30, 70, 50, 80, 30, 0, 100}, 1760}

Out[8]= $$\left\{\begin{pmatrix} -4 & bp & -6 & 1 & bp \\ bp & bp & bp & 0 & -1 \\ bp & -1 & -9 & bp & -7 \end{pmatrix}, \begin{pmatrix} 0 & 30 & 0 & 0 & 70 \\ 50 & 30 & 80 & 0 & 0 \\ 0 & 0 & 0 & 100 & 0 \end{pmatrix}\right\}$$

In[9]:=
```
T3 = TPivot[{{1, 4}, {3, 4}, {3, 1}, {2, 1}, {2, 2}, {1, 2}}, T2[[1]], T2[[2]], CM]
TObj[CM, T3[[1]], T3[[2]]]
```

Out[9]= {{{1, 4}, {1, 5}, {2, 1}, {2, 3}, {2, 2}, {3, 1}, {3, 4}}, {30, 70, 20, 80, 60, 30, 70}, 1730}

Out[10]=

$$\left\{\begin{pmatrix} -5 & -1 & -7 & bp & bp \\ bp & bp & bp & 0 & 0 \\ bp & -1 & -9 & bp & -6 \end{pmatrix}, \begin{pmatrix} 0 & 0 & 0 & 30 & 70 \\ 20 & 60 & 80 & 0 & 0 \\ 30 & 0 & 0 & 70 & 0 \end{pmatrix}\right\}$$