Step-1

A graph consists of a set of vertices or nodes, and a set of edges that connect them. The edge goes from node j to node k, then that row has -1 in column j and + 1 in column k.

The second graph represents the six games between four teams. So, the incidence matrix A for the second graph in the figure is,

$$A=\begin{bmatrix}-1 & 1 & 0 & 0\\ -1 & 0 & 1 & 0\\ 0 & -1 & 1 & 0\\ 0 & -1 & 0 & 1\\ -1 & 0 & 0 & 1\\ 0 & 0 & -1 & 1\end{bmatrix}$$

Step-2

The score differences are $b_1, b_2, \ldots, b_6$.We need to find the conditions, so that we can assign potentials $x_1, \ldots, x_4$ so that the potential differences agrees with the b â€™s.

Let $b=\begin{bmatrix}b_1\\ b_2\\ b_3\\ b_4\\ b_5\\ b_6\end{bmatrix}$

We need set the incidence matrix as $\begin{bmatrix}A & b\end{bmatrix}$. So,

$$\begin{bmatrix}A & b\end{bmatrix}=\begin{bmatrix}-1 & 1 & 0 & 0 & b_1\\ -1 & 0 & 1 & 0 & b_2\\ 0 & -1 & 1 & 0 & b_3\\ 0 & -1 & 0 & 1 & b_4\\ -1 & 0 & 0 & 1 & b_5\\ 0 & 0 & -1 & 1 & b_6\end{bmatrix}$$

Apply $R_1 \to R_1 + R_4$, $R_2 \to R_2 - R_5$and $R_4 \to R_4 - R_6$

$$
=\begin{bmatrix} -1 & 0 & 0 & 1 & b_1+b_4 \\ 0 & 0 & 1 & -1 & b_2-b_5 \\ 0 & -1 & 1 & 0 & b_3 \\ 0 & -1 & 1 & 0 & b_4-b_6 \\ -1 & 0 & 0 & 1 & b_5 \\ 0 & 0 & -1 & 1 & b_6 \end{bmatrix}
$$

Step-3

Apply $R_1 \to R_1 - R_5$ and $R_3 \to R_3 - R_4$

$$
=\begin{bmatrix} 0 & 0 & 0 & 0 & b_1+b_4-b_5 \\ 0 & 0 & 1 & -1 & b_2-b_5 \\ 0 & 0 & 0 & 0 & b_3-b_4+b_6 \\ 0 & -1 & 1 & 0 & b_4-b_6 \\ -1 & 0 & 0 & 1 & b_5 \\ 0 & 0 & -1 & 1 & b_6 \end{bmatrix}
$$

Apply $R_2 \to R_2 + R_6$

$$
=\begin{bmatrix} 0 & 0 & 0 & 0 & b_1+b_4-b_5 \\ 0 & 0 & 0 & 0 & b_2-b_5+b_6 \\ 0 & 0 & 0 & 0 & b_3-b_4+b_6 \\ 0 & -1 & 1 & 0 & b_4-b_6 \\ -1 & 0 & 0 & 1 & b_5 \\ 0 & 0 & -1 & 1 & b_6 \end{bmatrix}
$$

Therefore, $AX=b$ is solvable if

$$
\begin{aligned}
b_1+b_4-b_5&=0\\
b_3-b_4+b_6&=0\\
b_2-b_5+b_6&=0
\end{aligned}
$$

Therefore, it is possible at $\boxed{b_1+b_4-b_5=0, b_3-b_4+b_6=0 \text{ and } b_2-b_5+b_6=0}$