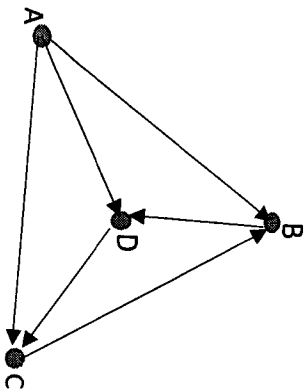


### Question 1

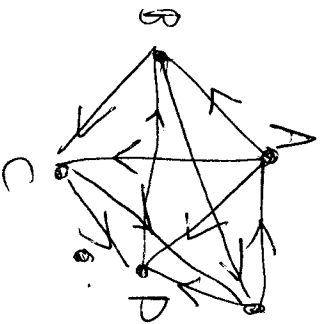
For the network diagram shown below, construct  $D$  and calculate  $D^2$ . Calculate  $T$  and hence rank the dominance of each vertex.



### Question 2

Five soccer teams, A, B, C, D and E play a tournament where no draws are allowed (if necessary games are decided by penalty shoot outs). The results were:

- A defeats B, C and D
- B defeats C and E
- C defeats D and E
- D defeats B
- E defeats A and D



$$D = \begin{matrix} & \begin{matrix} \text{from} \\ \text{A} \\ \text{B} \\ \text{C} \\ \text{D} \\ \text{E} \end{matrix} \\ \begin{matrix} \text{to} \\ \text{A} \\ \text{B} \\ \text{C} \\ \text{D} \\ \text{E} \end{matrix} & \begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix} \end{matrix}$$

$$D^2 = \begin{bmatrix} 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix}$$

- Draw a diagram to reflect these results and construct the dominance matrix  $D$ .
- Calculate  $T = D^2 + D$
- Rank the teams according to the matrix  $T$ .

$$T = \begin{matrix} & \begin{matrix} \text{from} \\ \text{A} \\ \text{B} \\ \text{C} \\ \text{D} \\ \text{E} \end{matrix} \\ \begin{matrix} \text{to} \\ \text{A} \\ \text{B} \\ \text{C} \\ \text{D} \\ \text{E} \end{matrix} & \begin{bmatrix} 0 & 2 & 2 & 2 & 2 \\ 0 & 1 & 0 & 1 & 2 \\ 0 & 1 & 1 & 0 & 2 \\ 0 & 1 & 1 & 1 & 2 \\ 1 & 2 & 1 & 2 & 0 \end{bmatrix} \end{matrix}$$

1st A  
2nd B & E  
3rd C  
4th D

$$\therefore T = D + D^2 =$$

$$\begin{matrix} & \begin{matrix} \text{A} \\ \text{B} \\ \text{C} \\ \text{D} \\ \text{E} \end{matrix} \\ \begin{matrix} \text{A} \\ \text{B} \\ \text{C} \\ \text{D} \\ \text{E} \end{matrix} & \begin{bmatrix} 0 & 2 & 2 & 2 & 2 \\ 0 & 1 & 0 & 1 & 2 \\ 0 & 1 & 1 & 0 & 2 \\ 0 & 1 & 1 & 1 & 2 \\ 1 & 2 & 1 & 2 & 0 \end{bmatrix} \end{matrix}$$