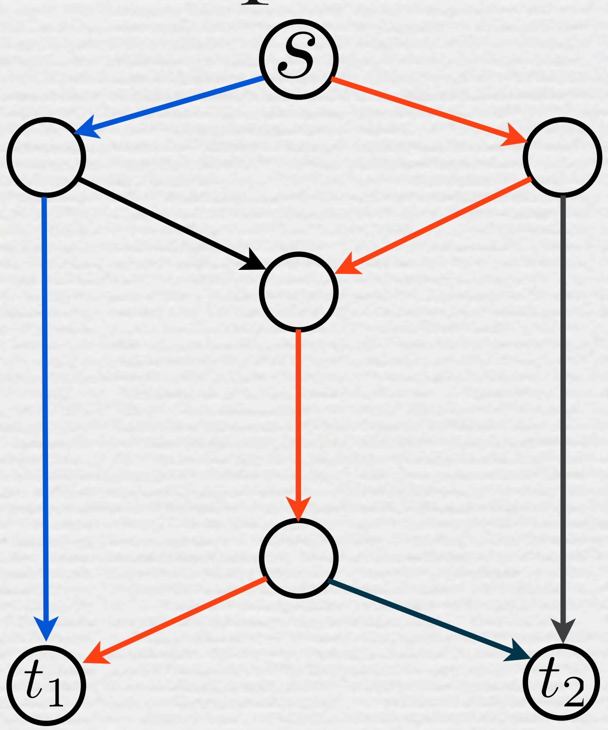
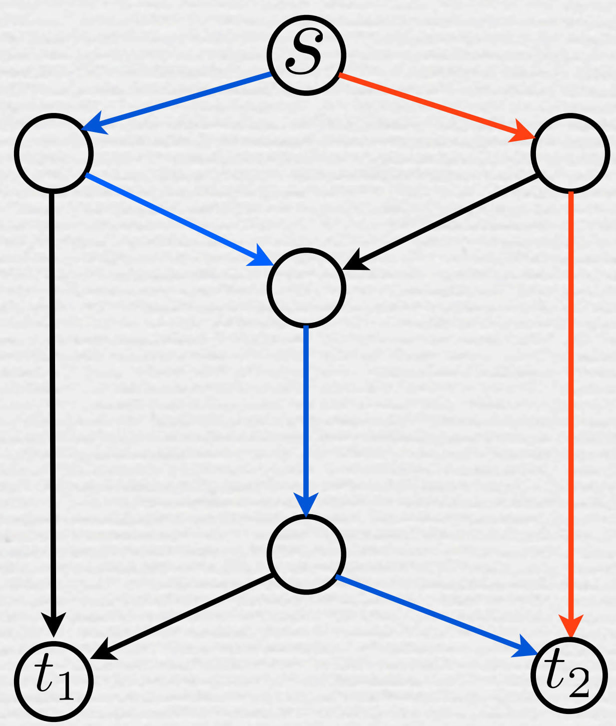
The Main Theorem of Network Coding

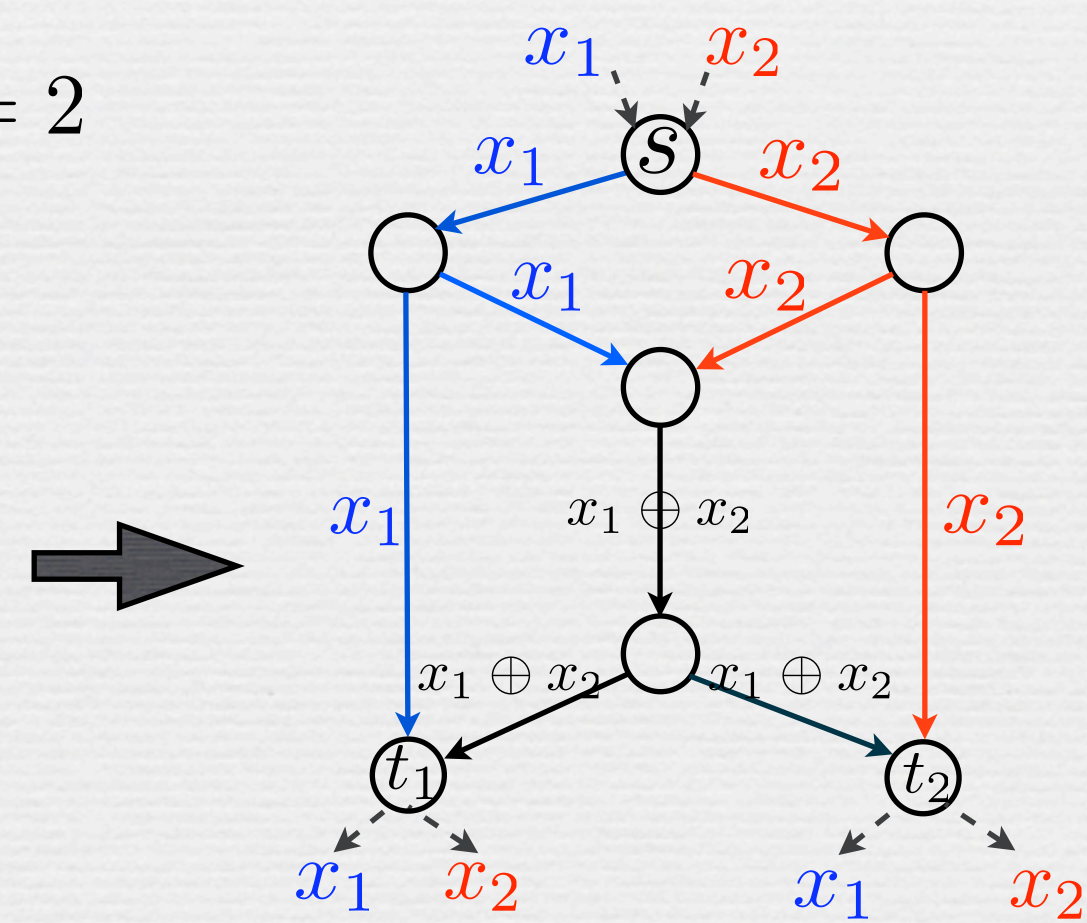
Example: condition (★) holds for $r = 2$



2 edge-disjoint paths from s to t_1

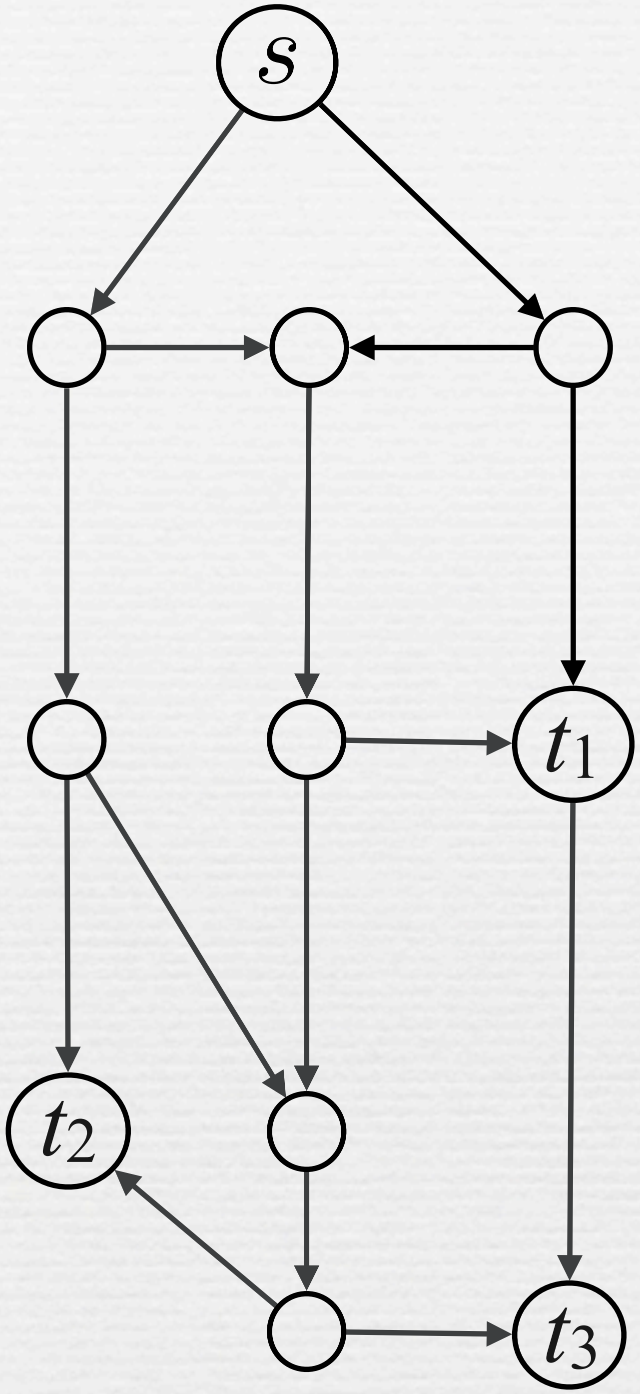


2 edge-disjoint paths from s to t_2

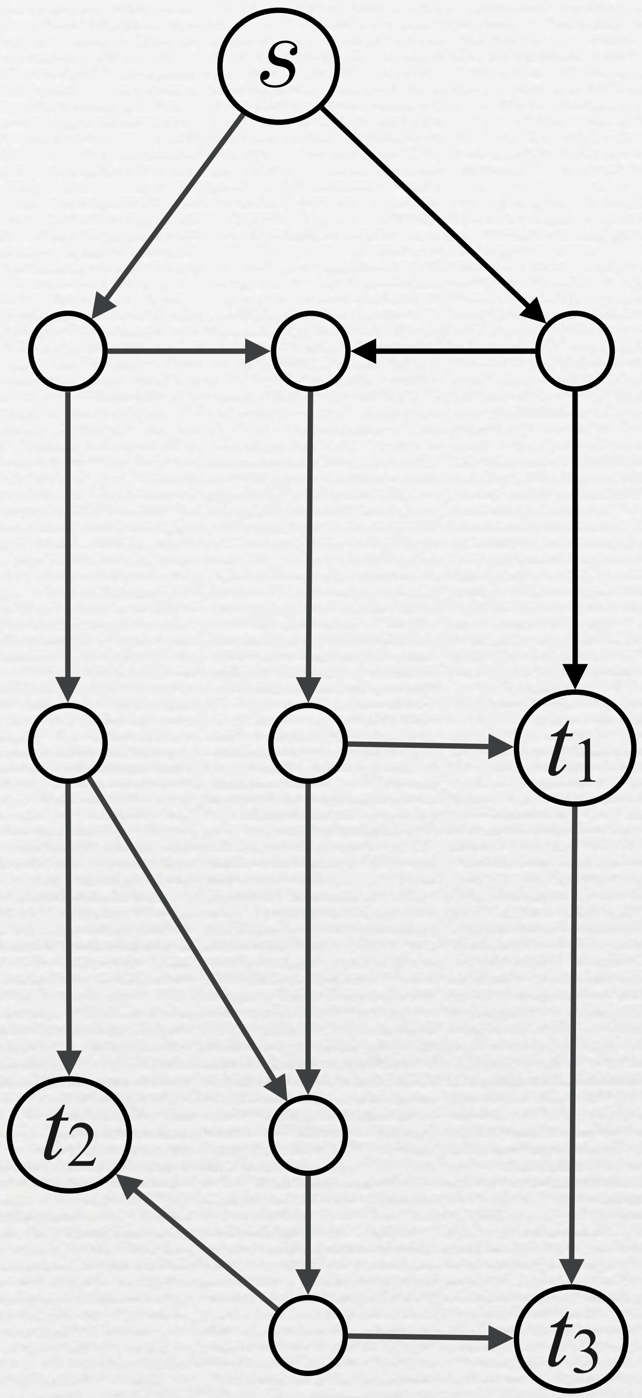


solvable at rate 2
(coding is required)

Overview of the Proof

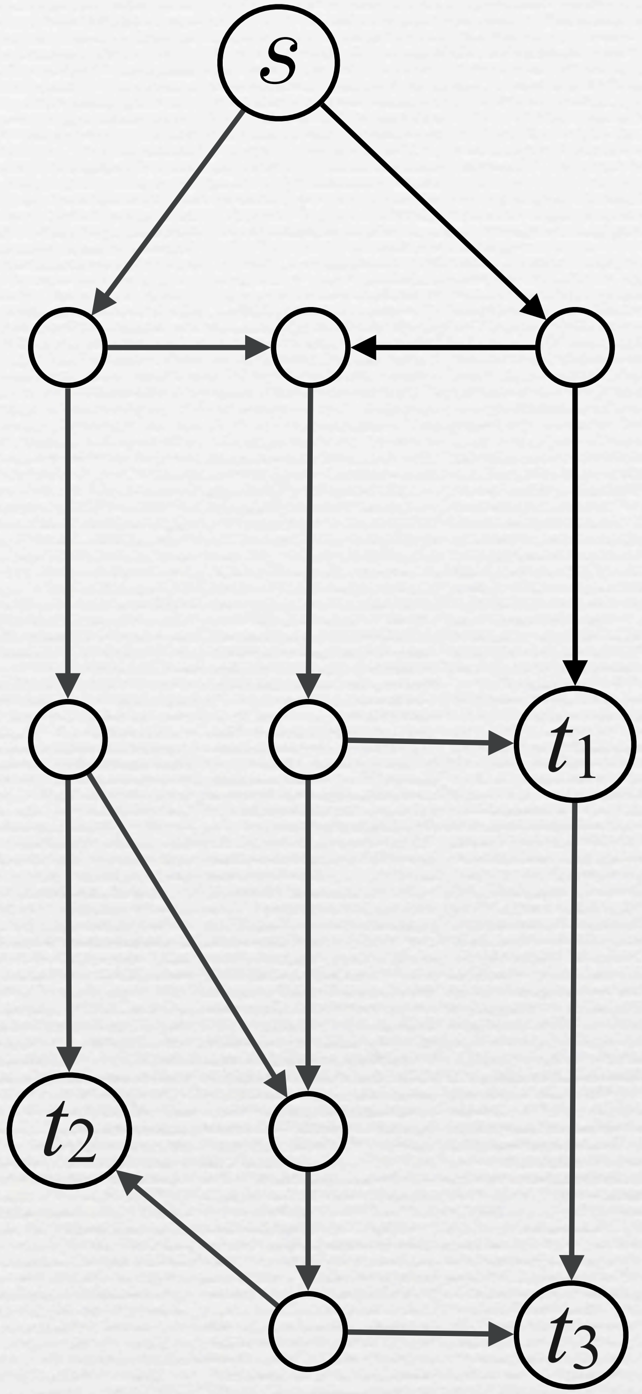


s
t_1
t_2
t_3

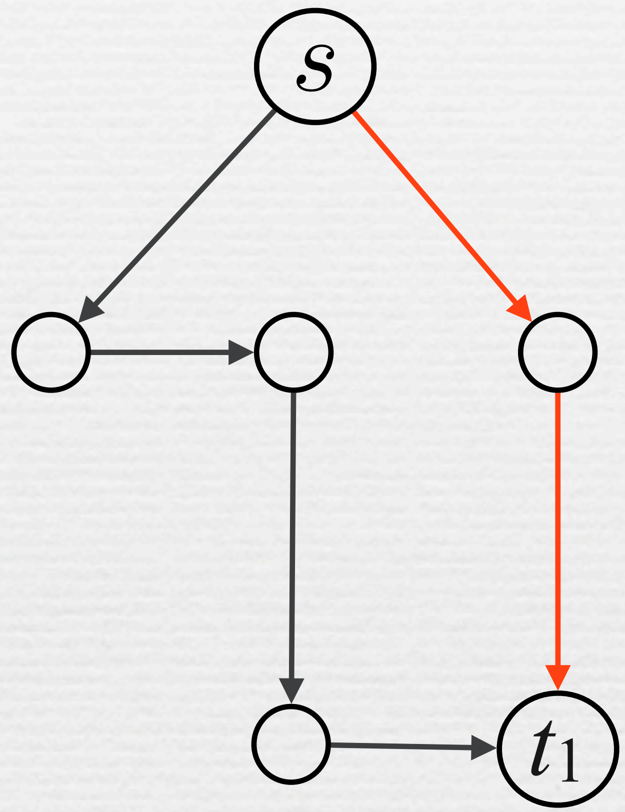


condition (★) holds for r = ?

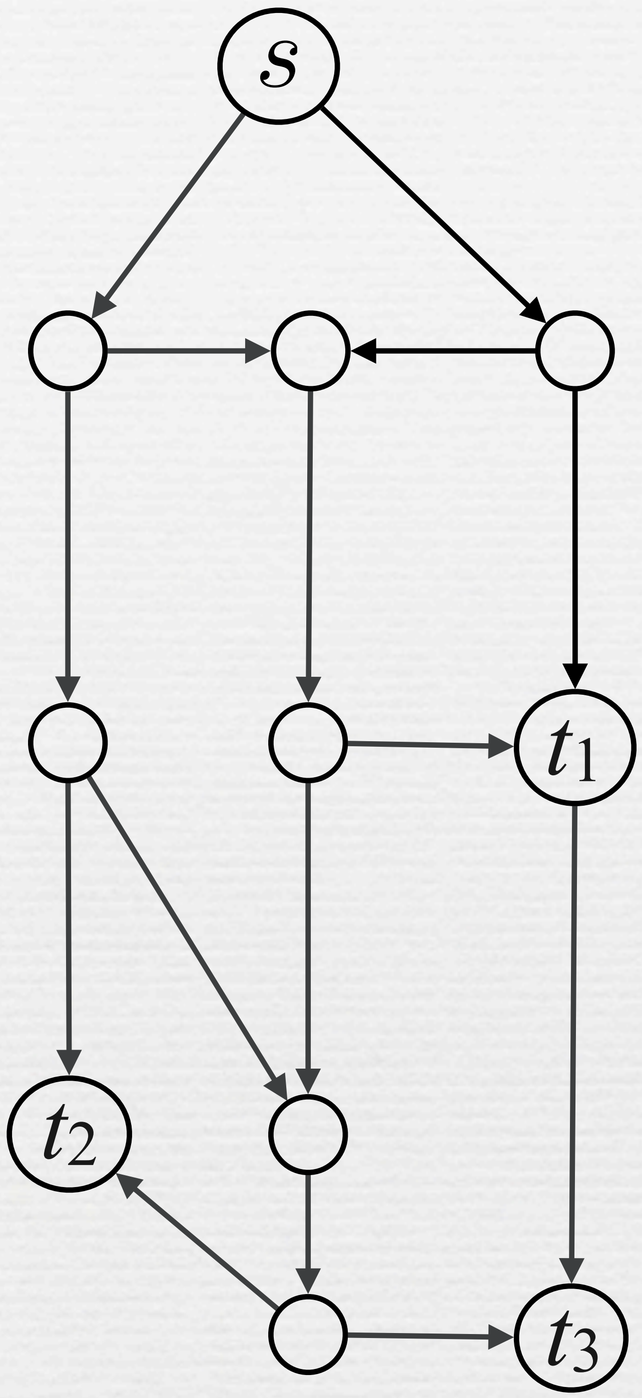
(★) for each vertex $t \in T$, there exist r edge-disjoint paths from s to t.



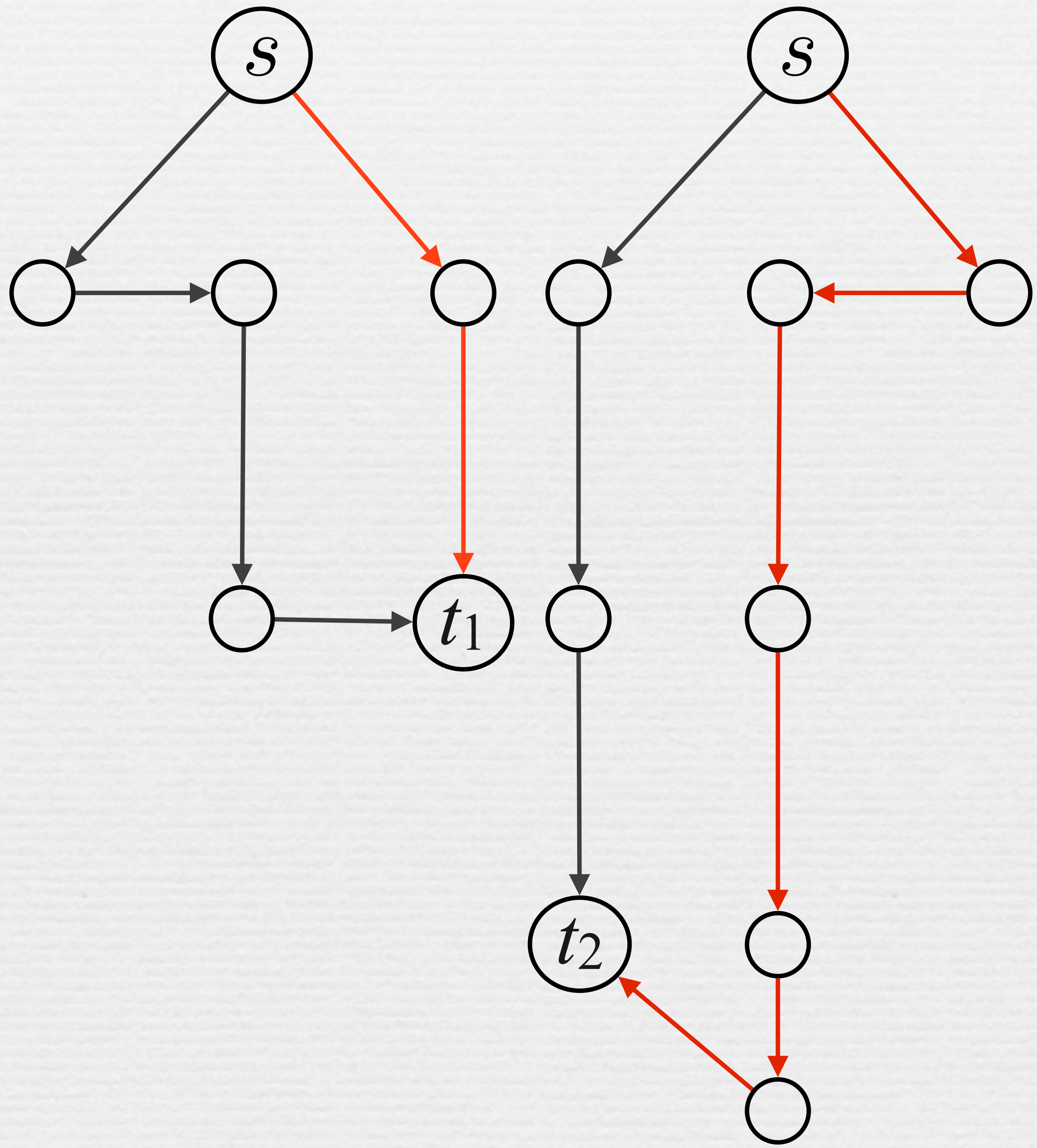
condition (★) holds for r = ?

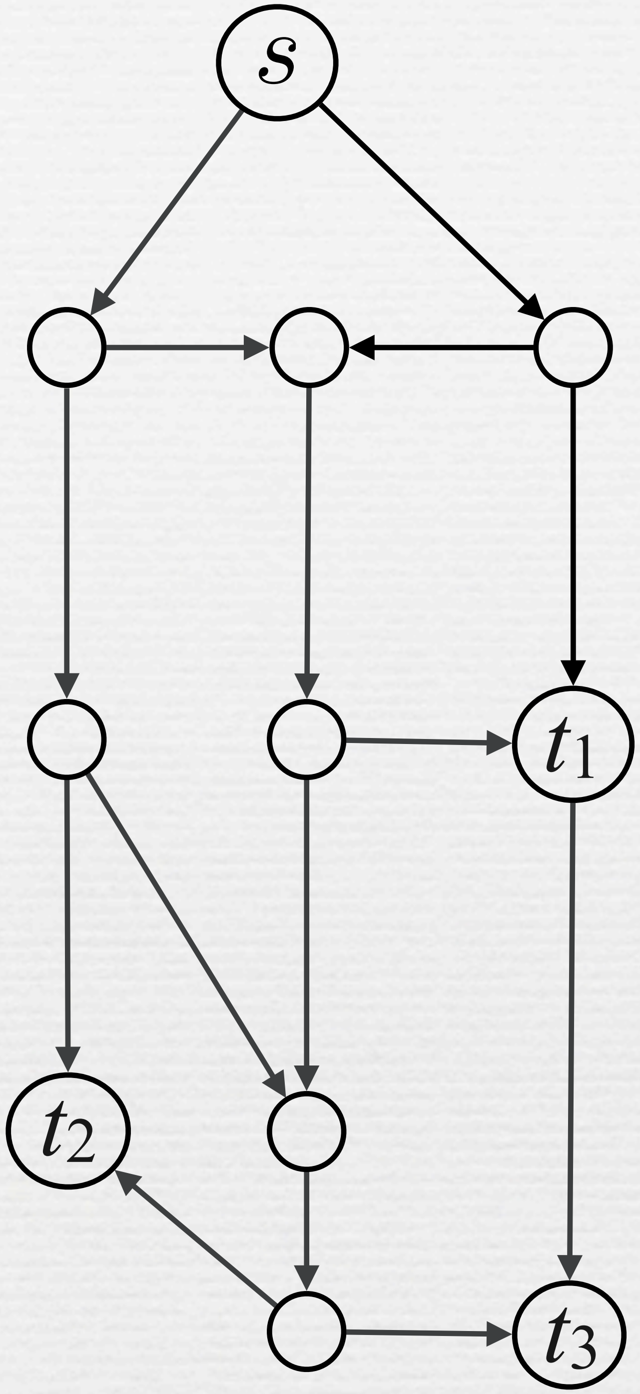


(★) for each vertex $t \in T$, there exist r edge-disjoint paths from s to t.

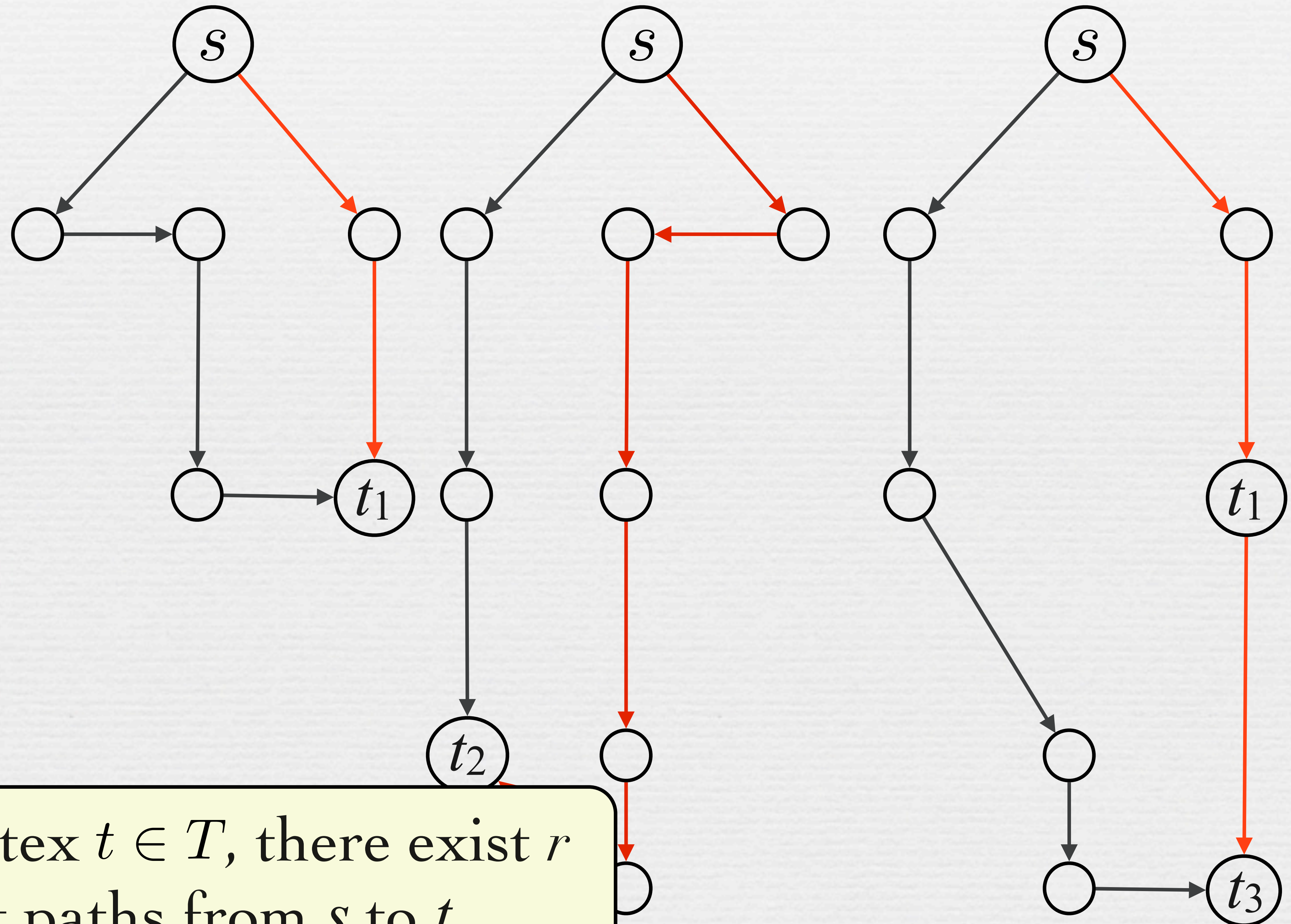


condition (★) holds for r = ?

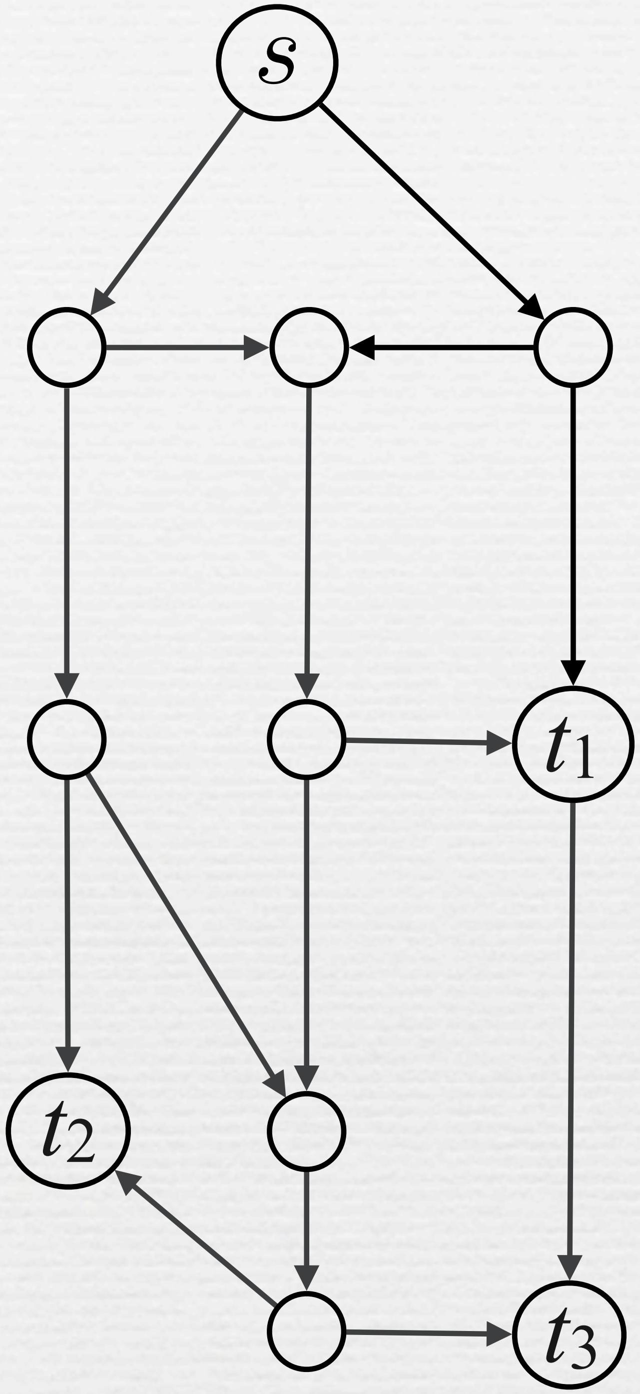




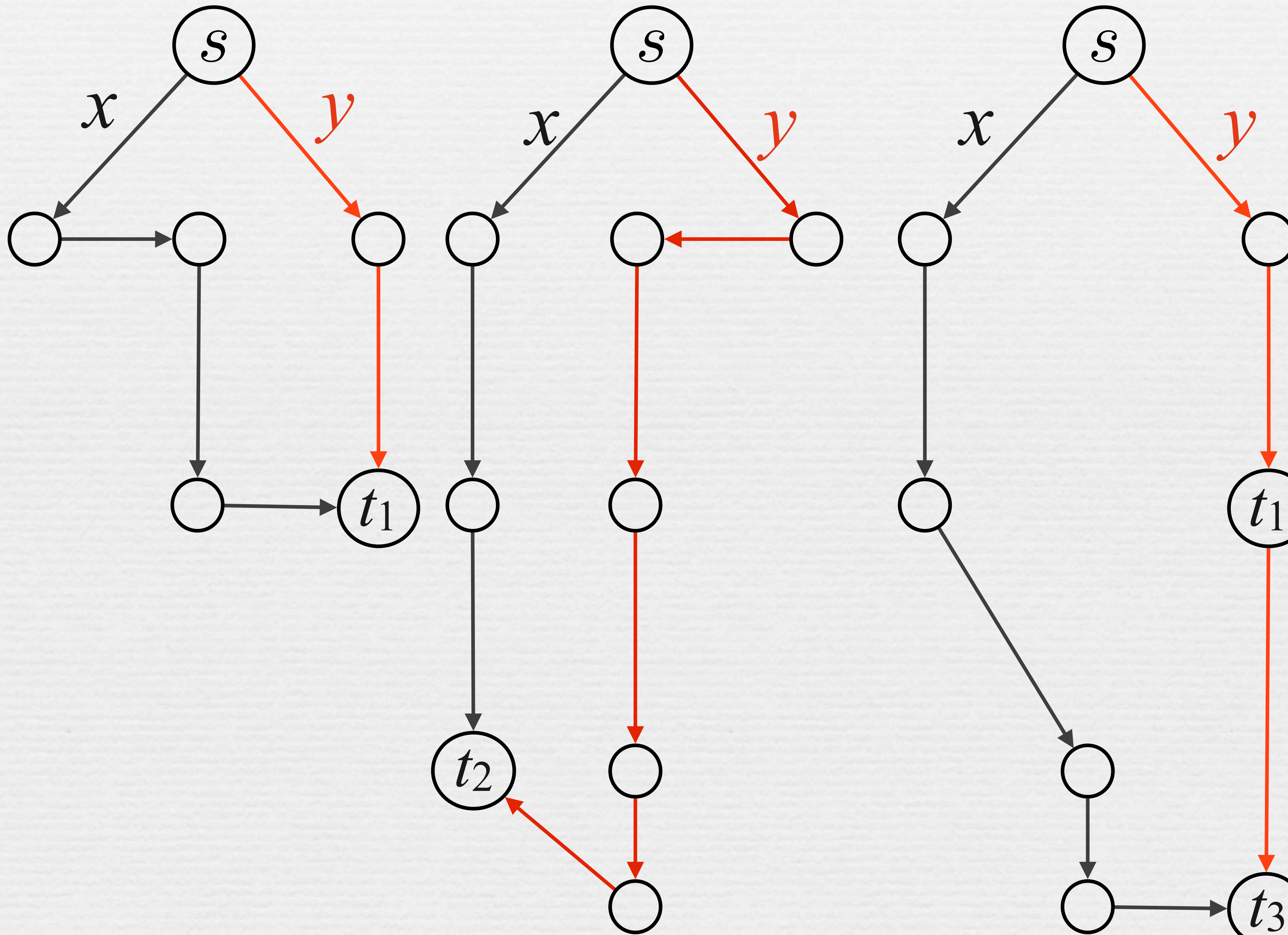
condition (★) holds for $r = 2$

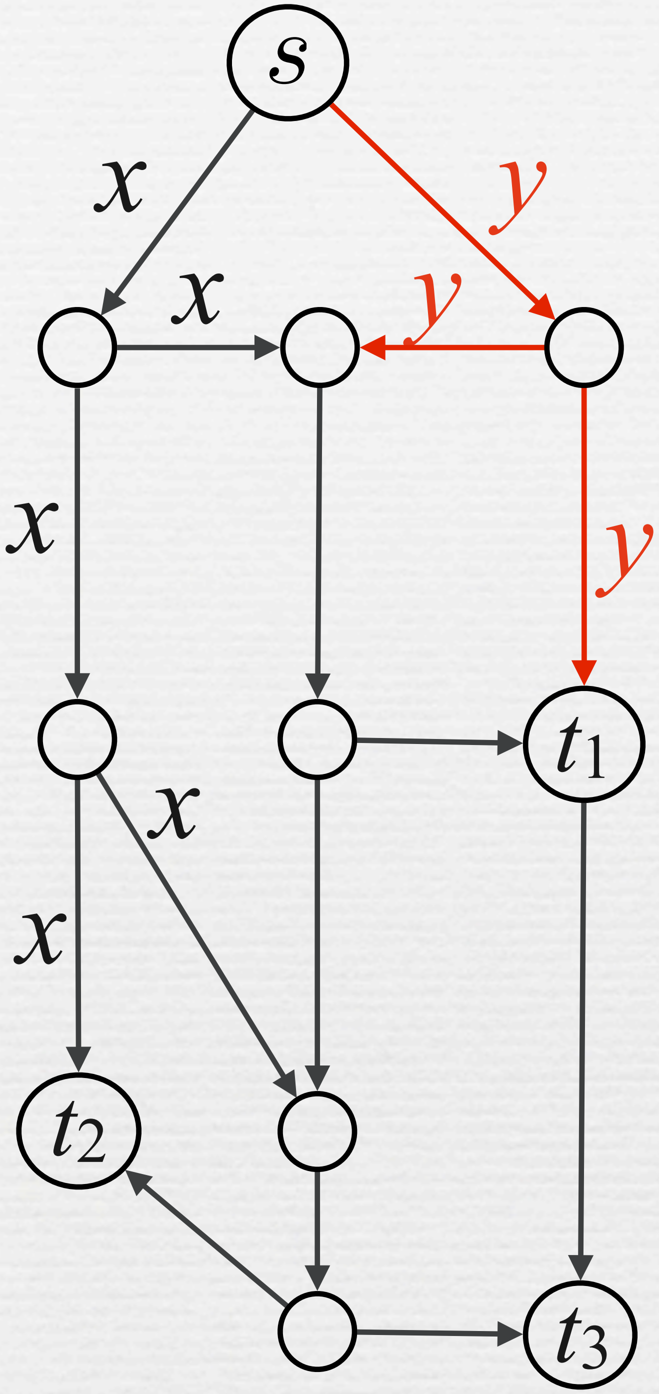


(★) for each vertex $t \in T$, there exist r edge-disjoint paths from s to t.

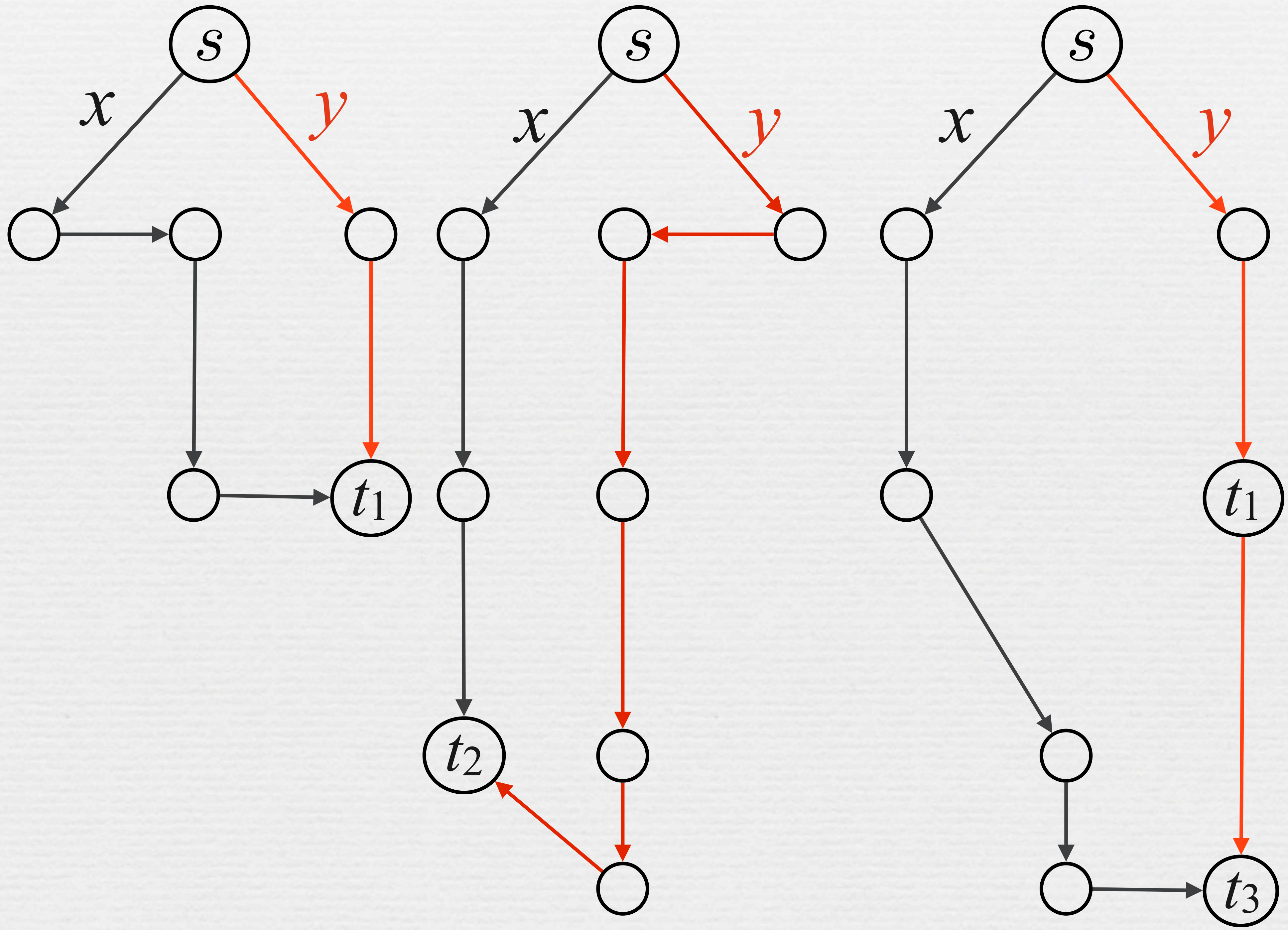


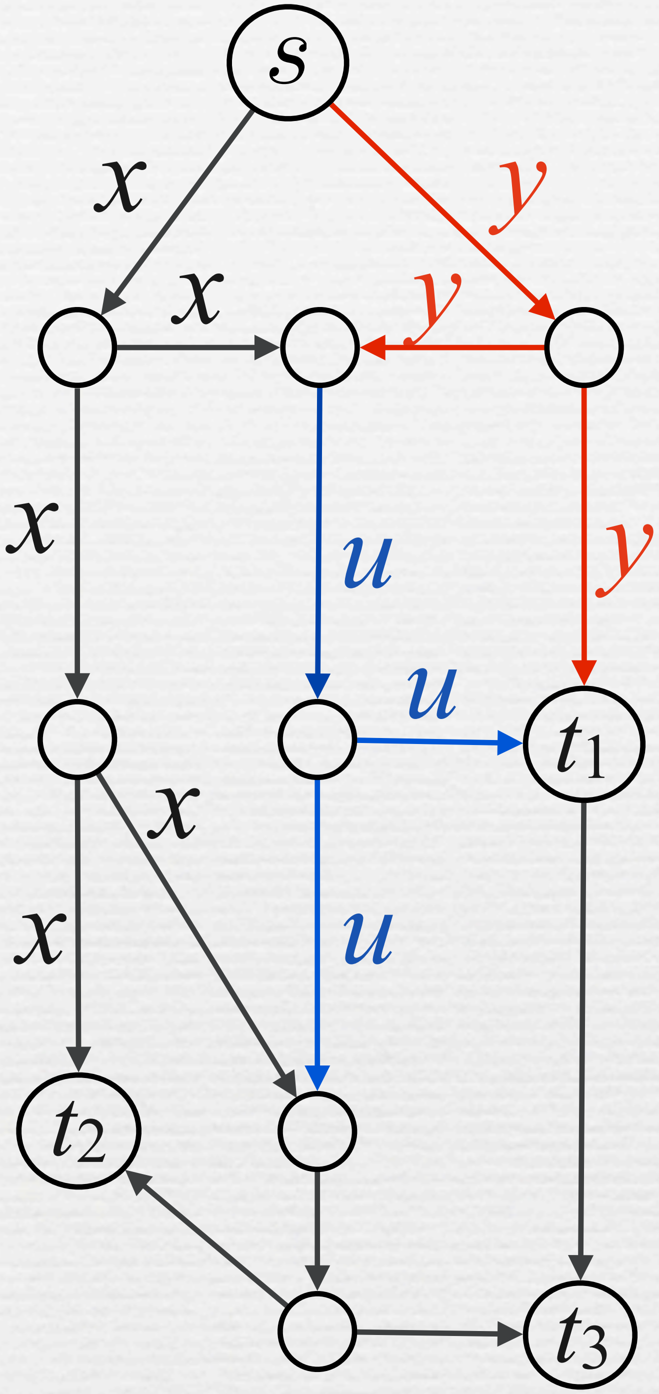
condition (★) holds for $r = 2$





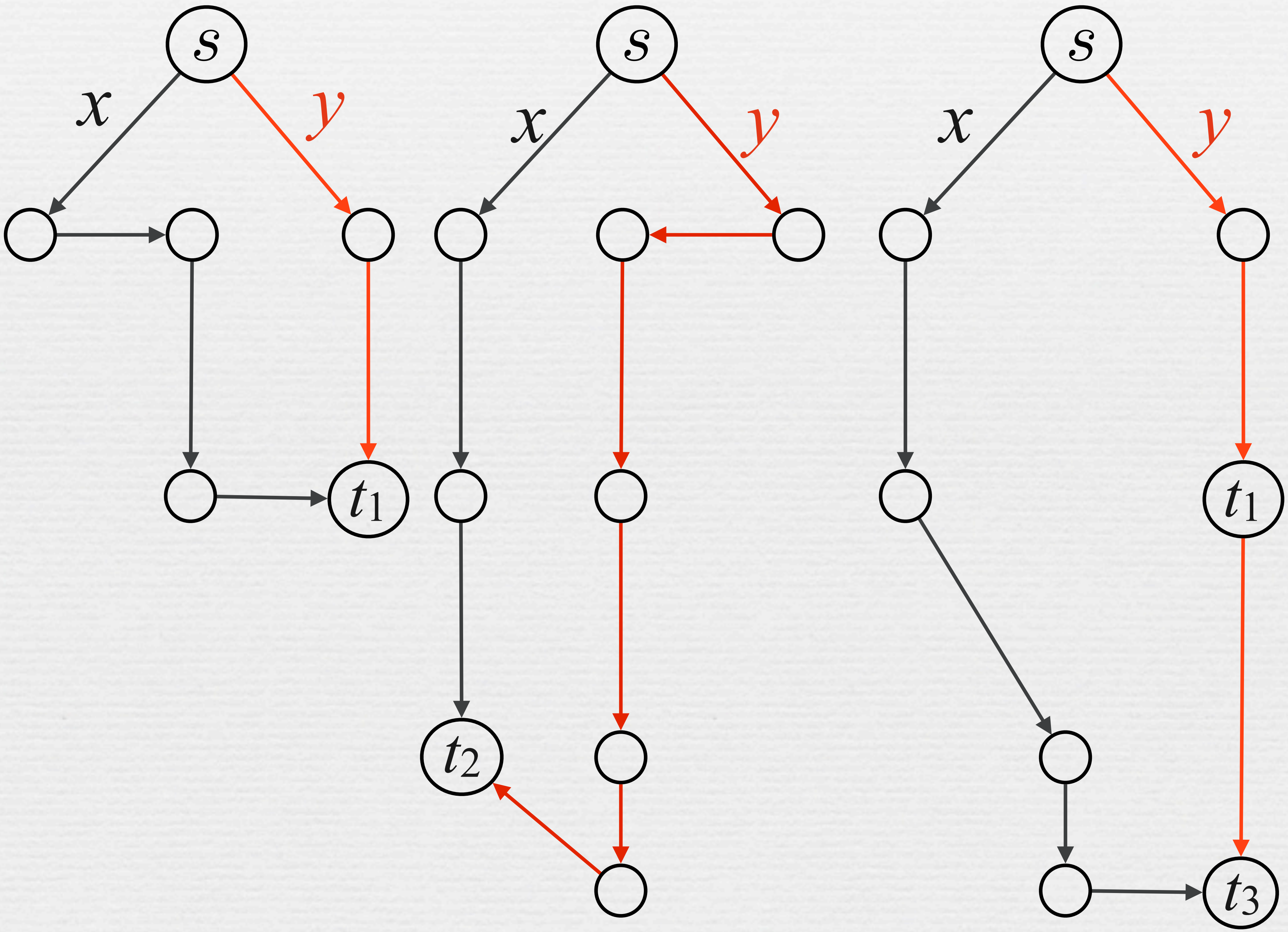
condition(★) holds for $r = 2$

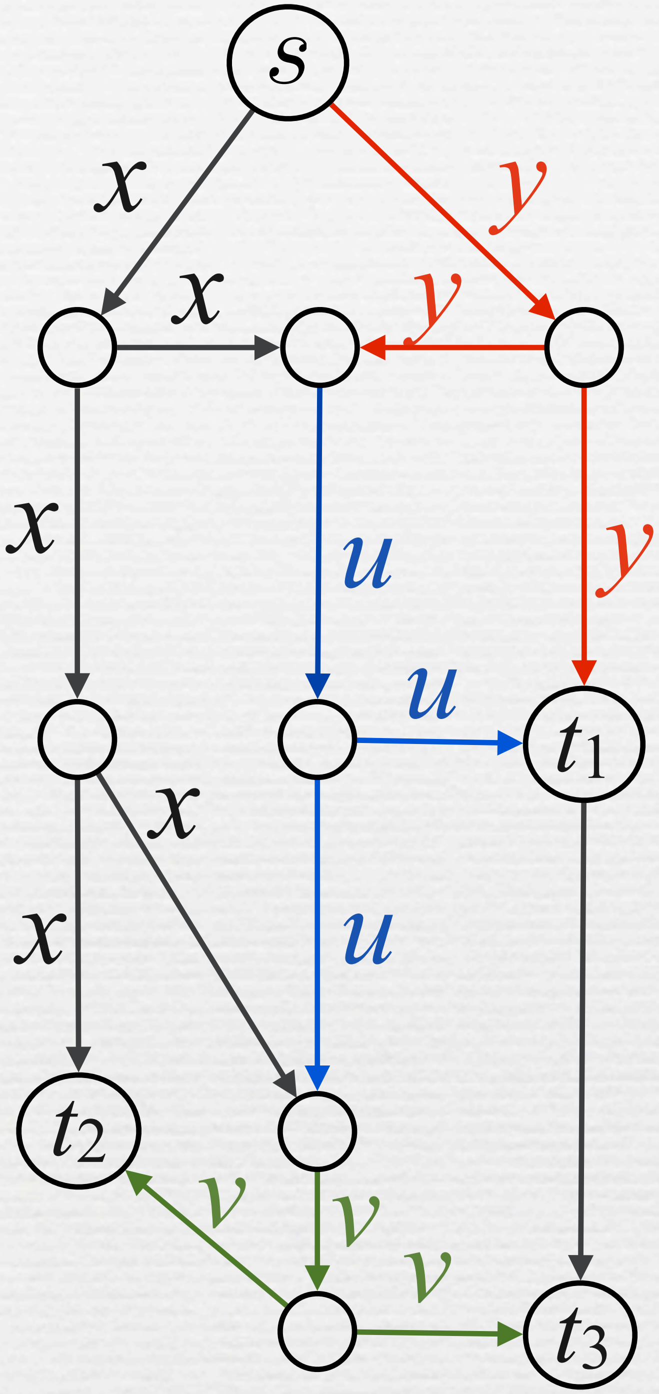




$u = ax + by$

condition (★) holds for $r = 2$

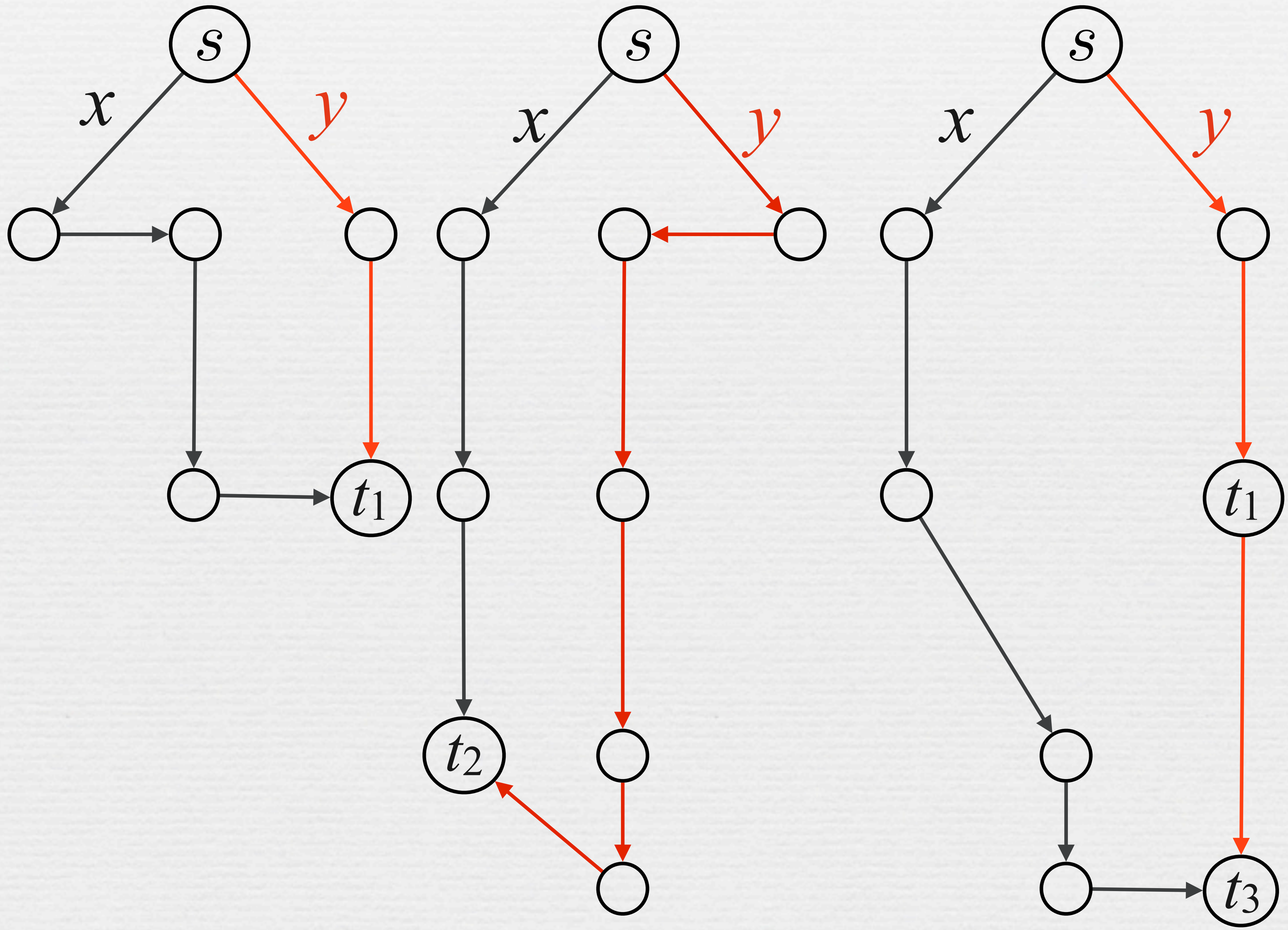




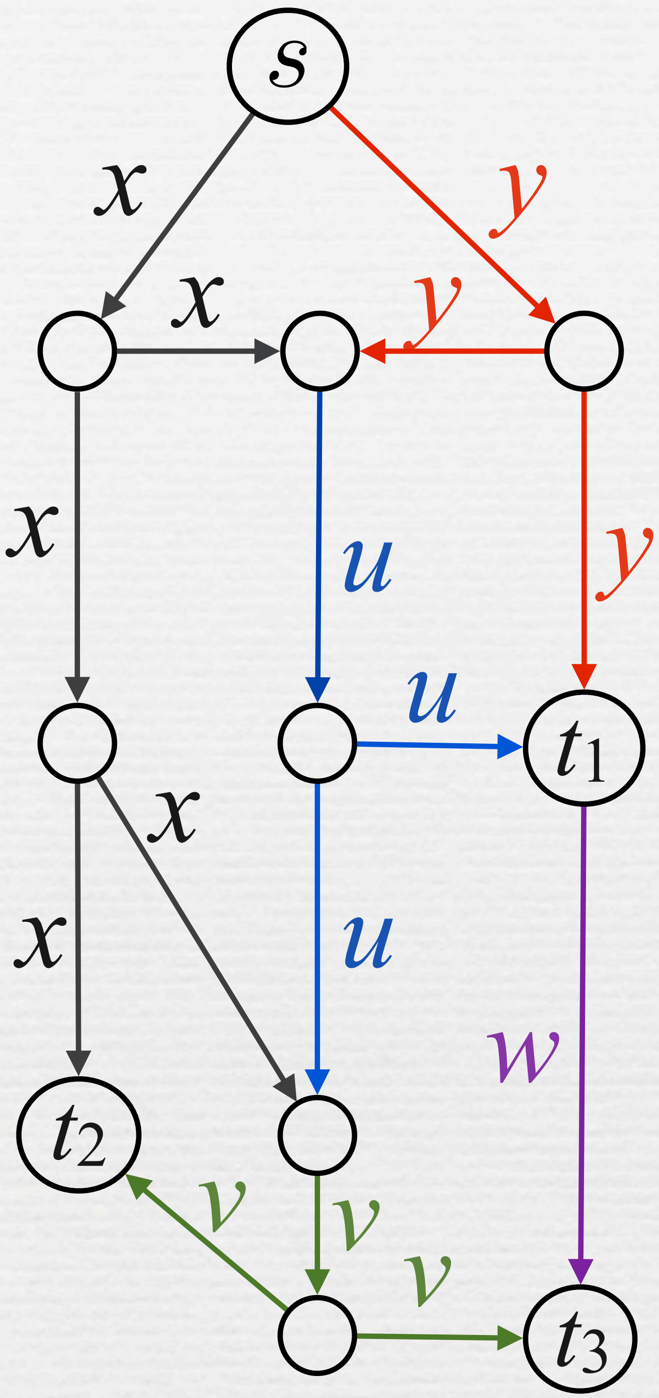
$u = ax + by$

$v = cx + du$

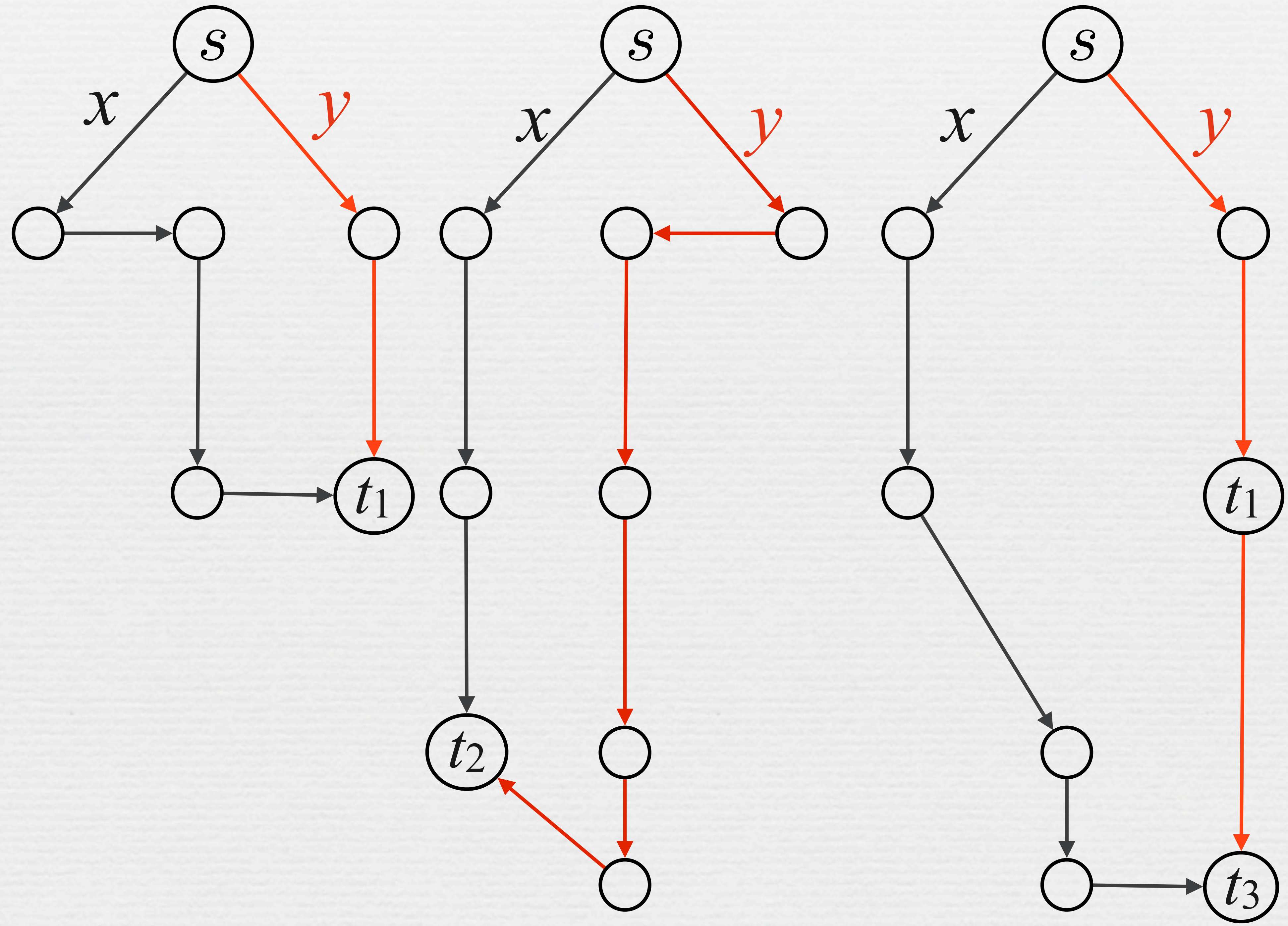
condition (★) holds for $r = 2$

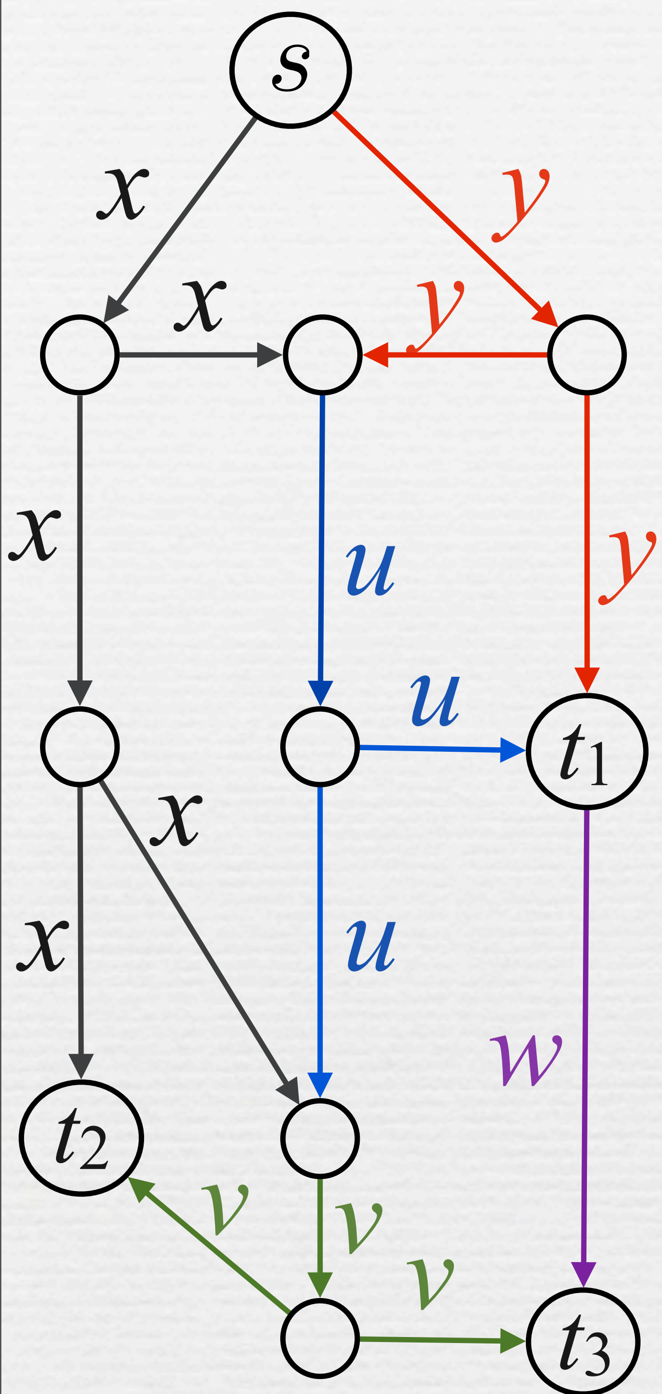


condition (★) holds for $r = 2$



$$u = ax + by$$
$$v = cx + du$$
$$w = eu + fy$$





$u = ax + by$

$v = cx + du$

$w = eu + fy$

at t_1: $$\begin{pmatrix} u \\ y \end{pmatrix} = \begin{pmatrix} a & b \\ 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

at t_2: $$\begin{pmatrix} x \\ v \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ c + ad & bd \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

at t_3: $$\begin{pmatrix} v \\ w \end{pmatrix} = \begin{pmatrix} c + ad & bd \\ ae & be + f \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

choose a,b,c,d,e and f such that the three matrices are invertible

example: $a=b=d=f=1$ and $c=e=0$