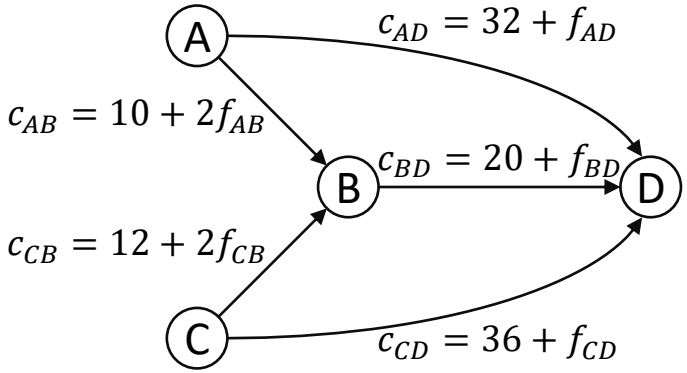
Control 4

La red a continuación ilustra un problema de equilibrio de tráfico con dos pares O/D:



$T_{AD} = 30$

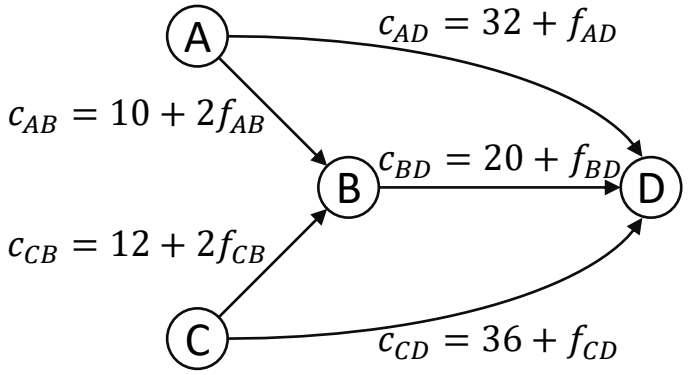
$T_{CD} = 20$

a. **4p** Construya un problema de optimización equivalente que permita resolver este problema de equilibrio, usando la transformada de Beckmann. Sea específico a esta instancia, y desarrolle los términos que se pueden desarrollar.

b. **2p** Verifique que la derivada de la función objetivo de la parte **a** con respecto al flujo de la ruta ABD corresponde al costo de la ruta ABD.

Control 4 – pauta

$T_{AD} = 30$
$T_{CD} = 20$



P.O.E.:

$$\min Z = 10f_{AB} + f_{AB}^2 + 32f_{AD} + 0{,}5f_{AD}^2 + 20f_{BD} + 0{,}5f_{BD}^2 + 12f_{CB} + f_{CB}^2 + 36f_{CD} + 0{,}5f_{CD}^2$$

s.a.

$$f_{AB} = h_{ABD}, \quad f_{AD} = h_{AD}, \quad f_{BD} = h_{ABD} + h_{CBD}$$
$$f_{CB} = h_{CBD}, \quad f_{CD} = h_{CD}$$

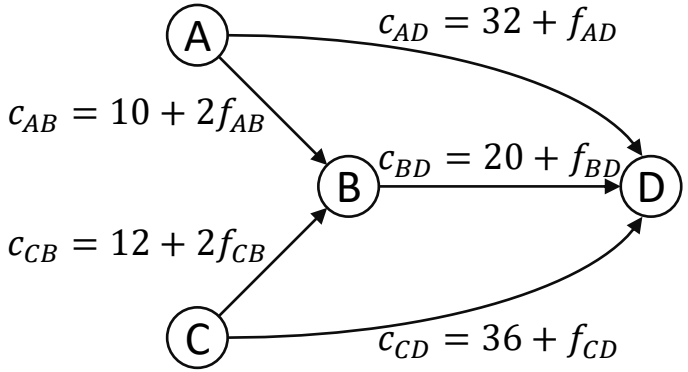
$$h_{ABD} + h_{AD} = 30$$
$$h_{CBD} + h_{CD} = 20$$

$$h_{ABD}, h_{AD}, h_{CBD}, h_{CD} \geq 0$$

Control 4 – pauta

$T_{AD} = 30$

$T_{CD} = 20$



$$Z = 10f_{AB} + f_{AB}^2 + 32f_{AD} + 0{,}5f_{AD}^2 + 20f_{BD} + 0{,}5f_{BD}^2 + 12f_{CB} + f_{CB}^2 + 36f_{CD} + 0{,}5f_{CD}^2$$

Tenemos que:

$$f_{AB} = h_{ABD}, \qquad f_{AD} = h_{AD}, \qquad f_{BD} = h_{ABD} + h_{CBD}, \qquad f_{CB} = h_{CBD}, \qquad f_{CD} = h_{CD}$$

Reemplazando:

$$Z = 10h_{ABD} + h_{ABD}^2 + 32h_{AD} + 0{,}5h_{AD}^2 + 20(h_{ABD} + h_{CBD}) + 0{,}5(h_{ABD} + h_{CBD})^2 + 12h_{CBD} + h_{CBD}^2 + 36h_{CD} + 0{,}5h_{CD}^2$$

Derivando:

$$\frac{\partial Z}{\partial h_{ABD}} = 10 + 2h_{ABD} + 20 + (h_{ABD} + h_{CBD}) = 30 + 3h_{ABD} + h_{CBD}$$

$$C_{ABD} = c_{AB} + c_{BD} = 10 + 2f_{AB} + 20 + f_{BD} = 30 + 3h_{ABD} + h_{CBD}$$