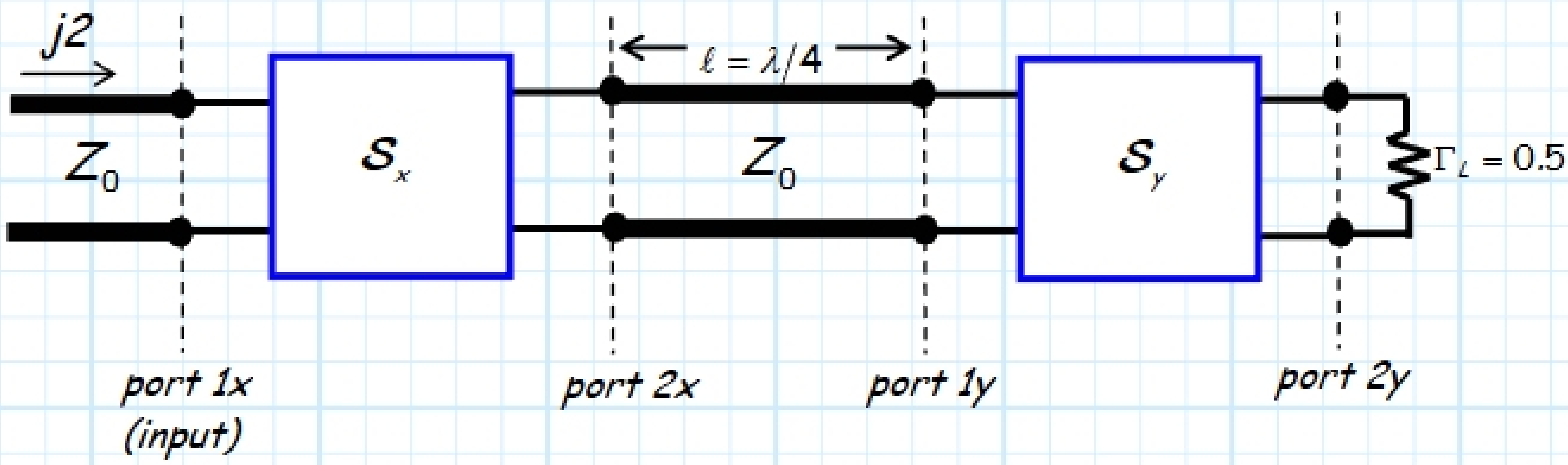
Example: Analysis Using Signal Flow Graphs

Below is a **single**-port device (with **input** at port 1a) constructed with two two-port devices ($\mathcal{S}_x$ and $\mathcal{S}_y$), a quarter wavelength transmission line, and a load impedance.



Where $Z_0 = 50\Omega$.

The scattering matrices of the two-port devices are:

$$\mathcal{S}_x = \begin{bmatrix} 0.35 & 0.5 \\ 0.5 & 0 \end{bmatrix} \qquad \mathcal{S}_y = \begin{bmatrix} 0 & 0.8 \\ 0.8 & 0.4 \end{bmatrix}$$

Likewise, we know that the value of the voltage wave **incident** on port 1 of device $\mathcal{S}_x$ is:

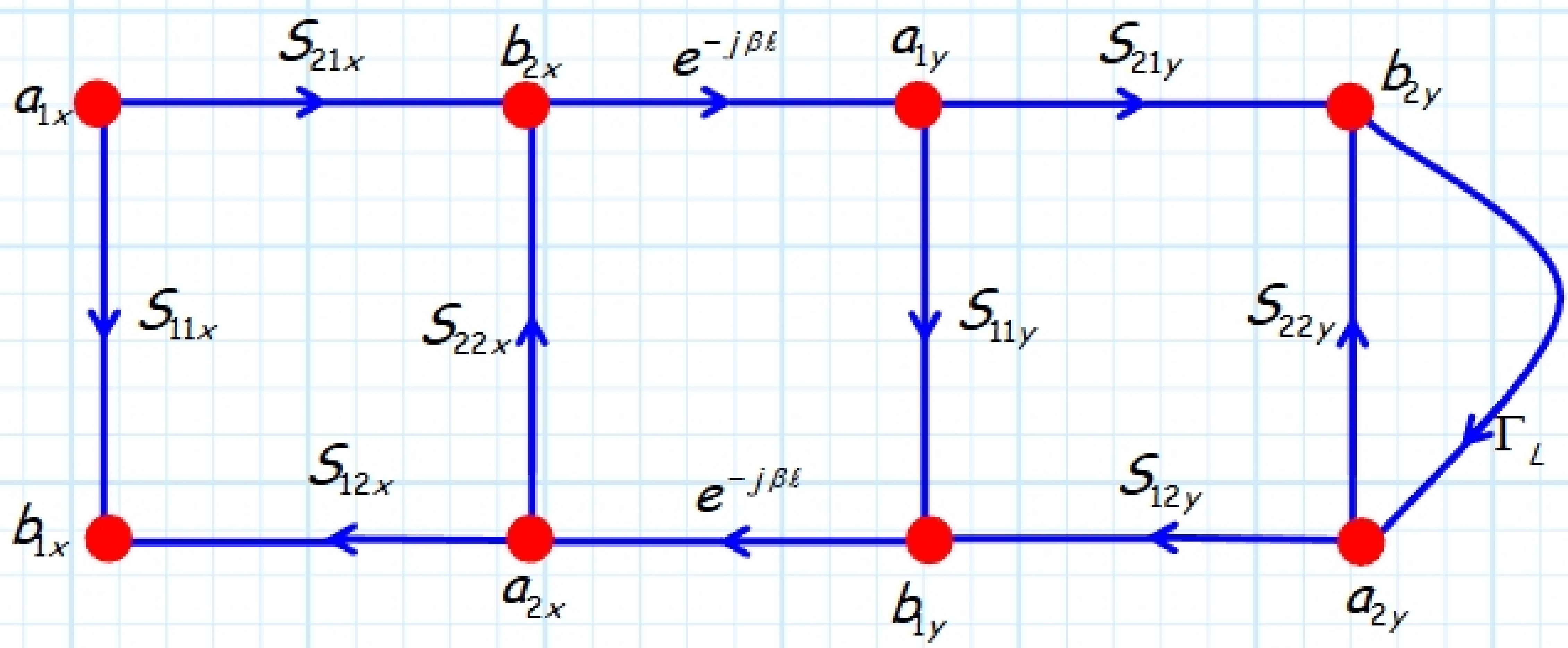
$$a_{1x} \doteq \frac{V_{01x}^{+}\left(z_{1x} = z_{1xP}\right)}{\sqrt{Z_0}} = \frac{j2}{\sqrt{50}} = \frac{j\sqrt{2}}{5} \quad V$$

Now, let's draw the complete **signal flow graph** of this circuit, and then reduce the graph to determine:

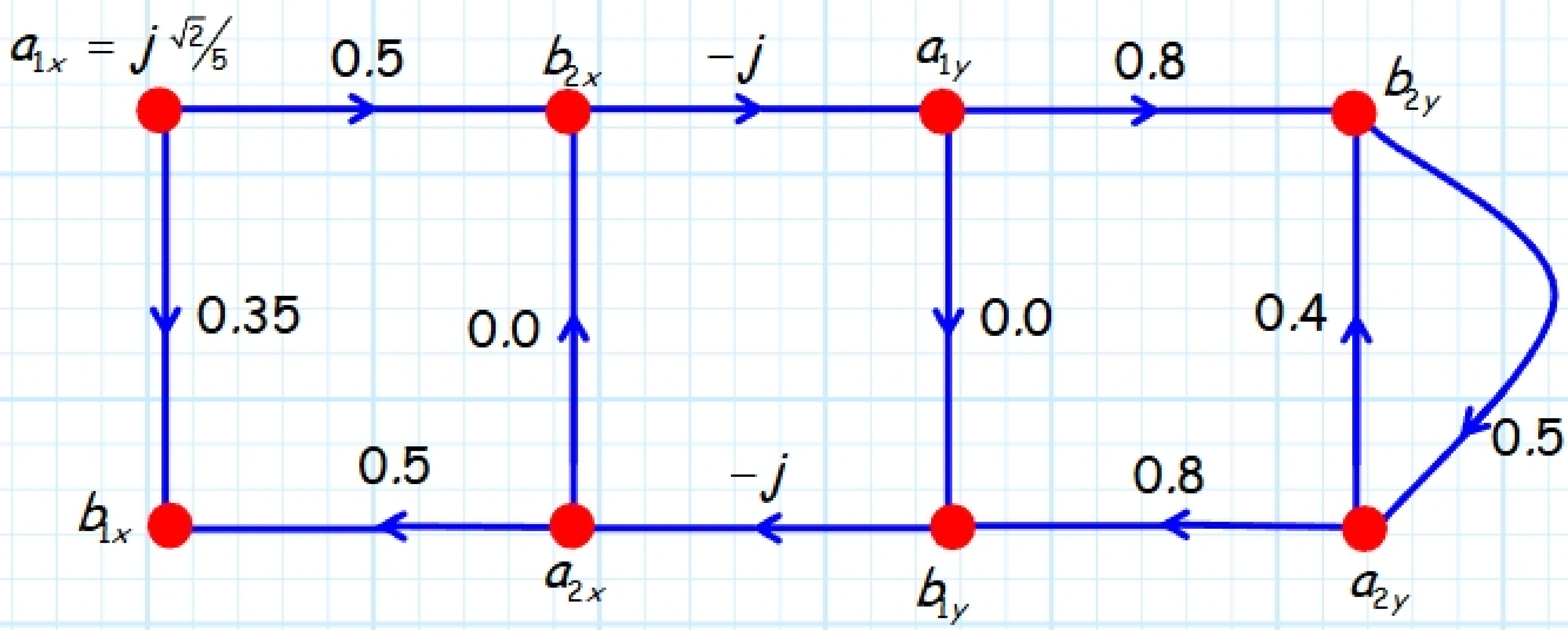
a) The total current through load Γ_L.

b) The power delivered to (i.e., absorbed by) port *1x*.

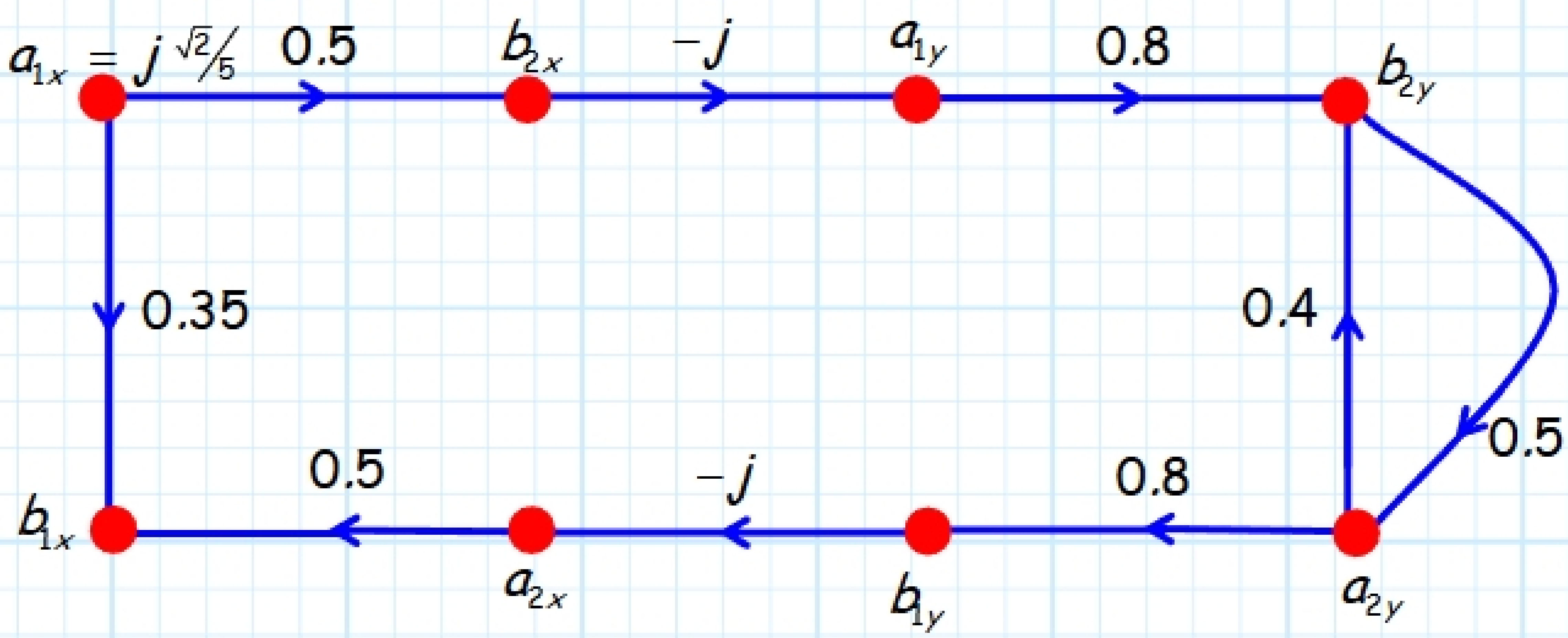
The signal flow graph describing this network is:



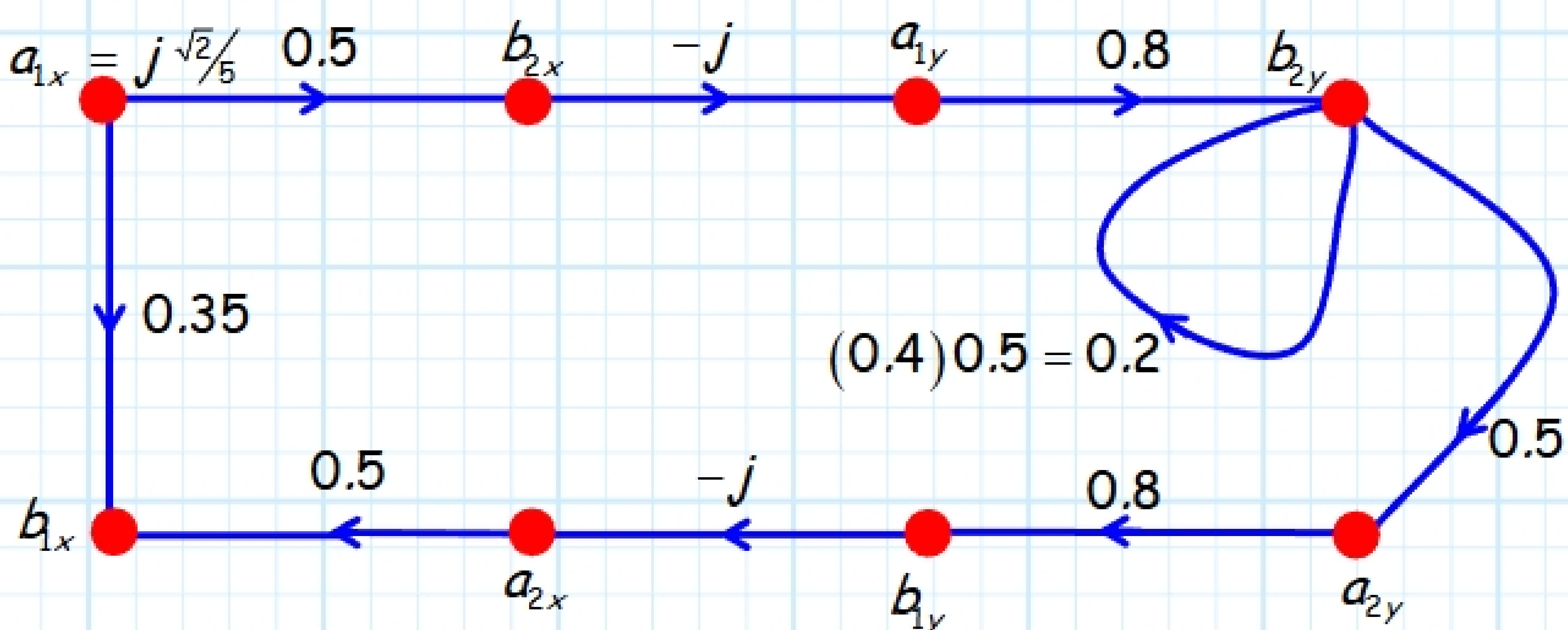
Inserting the numeric values of branches:



Removing the zero valued branches:



And now applying "splitting" rule 4:



Followed by the "self-loop" rule 3: