4.16 A four-port network has the scattering matrix shown below.

(a) Is this network lossless?

(b) Is this network reciprocal?

(c) What is the return loss at port 1 when all other ports are terminated with matched loads?

(d) What is the insertion loss and phase delay between ports 2 and 4, when all other ports are terminated with matched loads?

(e) What is the reflection coefficient seen at port 1 if a short circuit is placed at the terminal plane of port 3, and all other ports are terminated with matched loads?

$$[S] = \begin{bmatrix} 0.1\angle 90° & 0.8\angle -45° & 0.3\angle -45° & 0 \\ 0.8\angle -45° & 0 & 0 & 0.4\angle 45° \\ 0.3\angle -45° & 0 & 0 & 0.6\angle -45° \\ 0 & 0.4\angle 45° & 0.6\angle -45° & 0 \end{bmatrix}.$$