Quantum Coherent Transport

(Quantum Optics and Quantum Information Processing Laboratory, IISc Hackathon Prompt)

Background and Motivation

Networks connect nodes, devices, and entities across complex systems — from biological and chemical interactions to information and communication infrastructures.
Similarly, elementary quantum systems are interconnected in intricate ways.

Modelling the **dynamics of quantum networks** is essential not only for understanding these complex quantum interactions but also for **designing and simulating future quantum communication networks**.

Game

Let's transport a quantum state from A to B
Can we do it in more than one way, and what is the quantum circuit needed for this?
Mark each node with one unique basis state. Start and end nodes will have the same basis state. Design a quantum circuit for this with minimum circuit depth.

Hint: You can use an ancilla qubit if needed.