

### QCC 2022, Home Work 3

1. A circuit for the Quantum Discrete Fourier Transform (QDFT) with  $N = 4$  ( $n = 2$  qubits) is shown below. Let

$$|v_1\rangle = |10\rangle \text{ and } |v_2\rangle = |11\rangle$$

be used at the input of this circuit and  $|w_1\rangle$  and  $|w_2\rangle$  be the states at the output of the circuit. Find  $|w_1\rangle$  and  $|w_2\rangle$ .

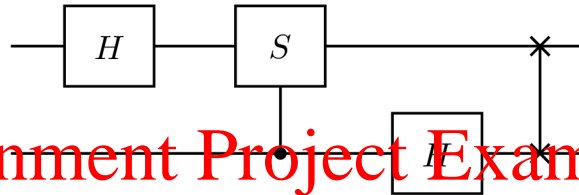


Figure 1: Quantum DFT,  $n = 2$ .

2. A circuit for the inverse QDFT is shown below. Let the input states be  $|w_1\rangle$  and  $|w_2\rangle$  obtained in the previous problem. Let  $|u_1\rangle$  and  $|u_2\rangle$  be the output states. Find  $|u_1\rangle$  and  $|u_2\rangle$ .

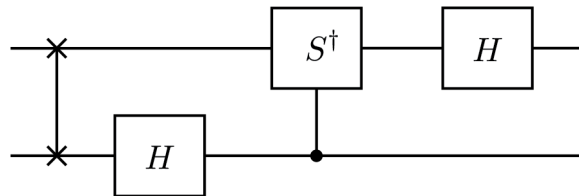


Figure 2: Quantum Inverse DFT,  $n = 2$ .

Reminding:  $S^\dagger$  denotes the Hermitian conjugation of  $S$ .