QCC 2022, Home Work 3

1. A circuite 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 circuite and $|w_1\rangle$ and $|w_2\rangle$ be the states at the output of the circuite. Find $|w_1\rangle$ and $|w_2\rangle$.

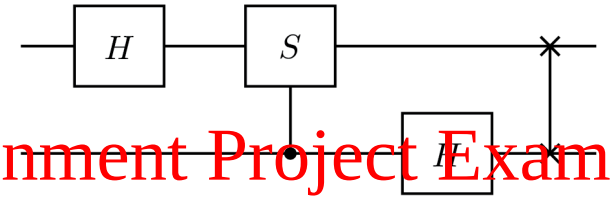

Figure 1: Quantum DFT, $n = 2$.

2. A circuite 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 $|u_2\rangle$.

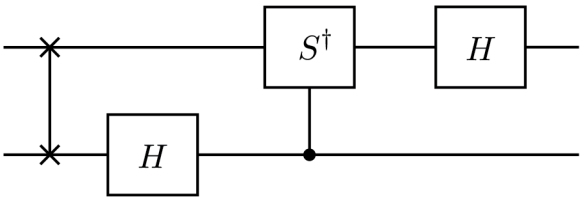

Figure 2: Quantum Inverse DFT, $n = 2$.

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