Homework 5

1. For the unitary transformation U from Problem 5 of HW 4, find all the vectors $|u_s\rangle$, $s = 0, \ldots, r-1$, and check that they are eigenvectors of U.

2. Compute explicitly $\sum_{s=0}^{r-1} |u_s\rangle$.

3. Find the joint quantum state of all $t + L$ qubits right before the measurement blocks in the quantum circuit from Problem 6 of HW 4 . Recall that in Problem 6 of HW 4 we used $t = 4$.

4. Find all possible classical outputs of the measurements with corresponding probabilities.

5. Let $N = 21$ and $x = 3$. Find $\gcd(x, N)$ and decide whether $\gcd(x, N)$ is a nontrivial factor of N or not.

6. Let $N = 21$ and $x = 5$. Find $\gcd(x, N)$ and decide whether $\gcd(x, N)$ is a nontrivial factor of N or not.

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