A. What is $H^{\otimes n} \otimes H^{\otimes n}$?

B. In lecture we proved a theorem about $H^{\otimes n} |\alpha\rangle$. The proof had a rather large algebra step that wasn't as clear as it could be. The step becomes clearer if we re-organize the proof to be a proof by induction. So your assignment is: Prove the theorem by induction for all $n \geq 1$. (The base case $n = 1$ was already done in lecture.)

C. In lecture we proved a theorem about $F |\alpha\rangle |-\rangle$. Another interpretation of that theorem is that we're demonstrating 2^n eigenvectors for F. Each eigenvalue is 1 or -1, depending on exactly which f underlies F. So my question for you is: Where are the other 2^n eigenvectors for F? (Yes, it has all 2^{n+1} eigenvectors.)

D. Here is a classical seven-bit operation:

$$|\alpha\beta\gamma\delta\zeta\eta\theta\rangle \mapsto |\alpha\rangle |\beta\rangle |\gamma\rangle |\delta\rangle |\zeta \oplus (\alpha \odot \gamma) \oplus (\alpha \odot \beta \odot \delta) \oplus (\gamma \odot \beta \odot \delta)\rangle |\eta \oplus \alpha \oplus \gamma \oplus (\beta \odot \delta)\rangle |\theta \oplus \beta \oplus \delta\rangle .$$

Is it invertible? What does it do, in English? (Hint: Analyze it from right to left.)