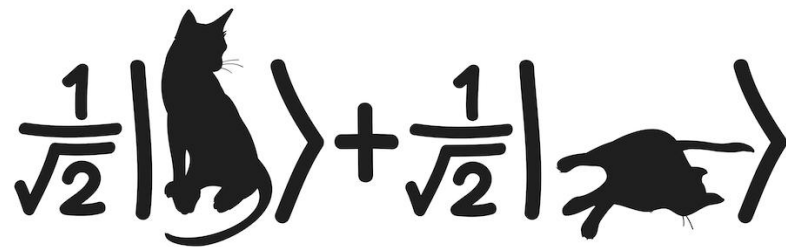


Quantum Mechanics & Quantum Computation

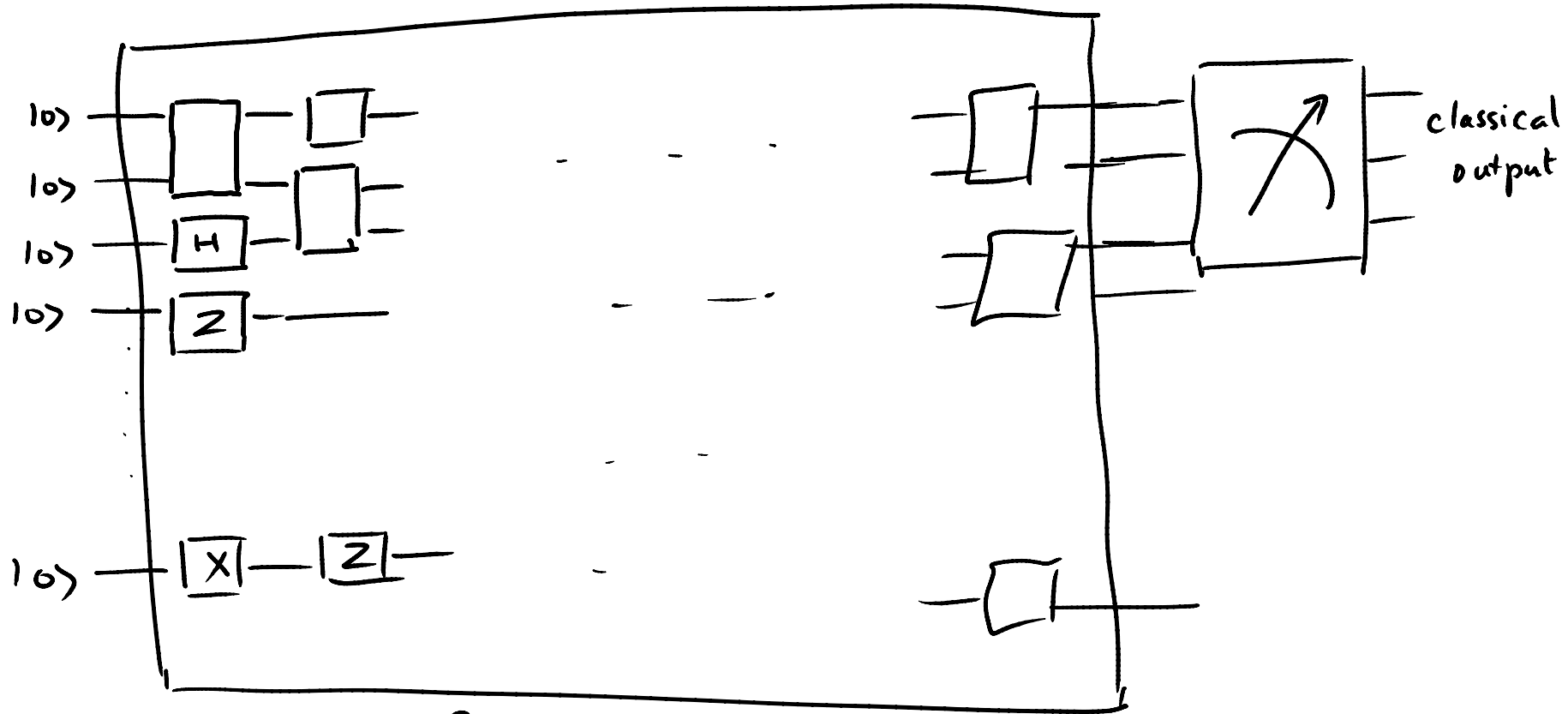
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Lecture 11: Quantum Circuits

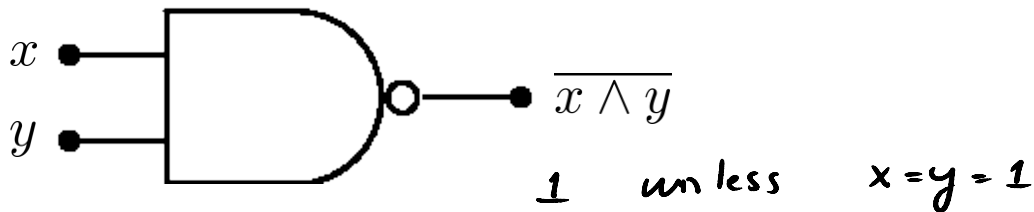
Universal family of gates



Quantum Circuit.

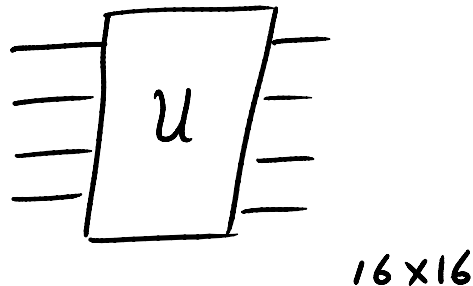
Universal quantum gate set

- In classical circuits, a certain set of gates enables universal computation.
- Ex) NAND is universal

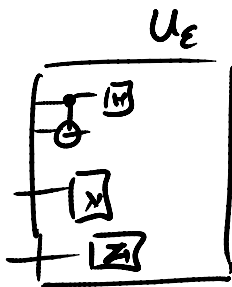


Universal quantum gate set

- Quantum analogue?
 - CNOT, H, X, Z, $\frac{\pi}{8}$ rotations
- What does it mean?
 - Clearly, we cannot implement an arbitrary U with infinite precision.
 - Instead, given ϵ , we implement U_ϵ which is ϵ -close to U .



$d \times d$



$$O(\underline{\underline{d^2 \log^3 \frac{1}{\epsilon}}})$$

$$\|U - U_\epsilon\| \leq \epsilon.$$