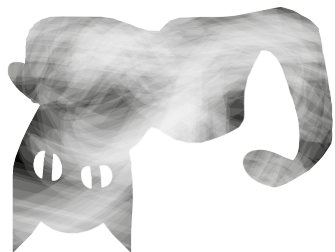


# NO-CLONING THEOREM



## HOW DO YOU GET SOMETHING FROM ONE PLACE TO ANOTHER?

You move it, of course!



## WE MOVE THINGS ALL THE TIME!



From books...

...to groceries...



...to people!

## WE ALSO MOVE INFORMATION!



Talking!



Texting!



Sending mail!

## COMPUTERS ALSO DO THIS!

(That's how they calculate things!)

"You have 99 unread messages."

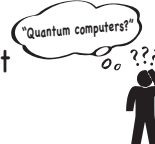
"5 + 7 = 12"



"The nearest ice cream shop is 1 mile away."

## QUANTUM COMPUTERS DO, TOO!

They just store information in a bit of a weird way.



## QUANTUM COMPUTERS STORE INFORMATION IN QUBITS

The information stored in a qubit at any moment is called its "state."

Other things have states, too:




A TV has two basic states: "on" and "off"!

Your emotions are a kind of state for how you're feeling: Happy, Sad, Angry, etc.



Qubits can be in one of the basic states of "0" or "1" - or something much more complex!

## HOW CAN WE SEND STATES? IN QUANTUM COMPUTING?

Say Alice wants to send Bob a qubit in the  state.



Alice could ship her qubit to Bob, but complex qubit states are VERY FRAGILE!

Light, heat, and vibration can change a qubit's state unintentionally - this is called "decoherence."



Imagine walking to a friend's house with an ice cream cone on a hot summer day... YIKES!!

## DECOHERENCE CAUSES INFORMATION TO BE LOST!



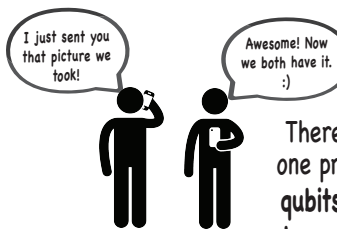
Alice should look for a safer way to send her message!



Could Alice just send a COPY of her qubit?

## THE NO-CLONING RULE

We copy & send information all the time in real life...



There's just one problem... qubits can't be copied!!!

**The No Cloning Rule:** A qubit's state cannot be copied to another qubit - without changing the original.

I'm just one of a kind!



So how can Alice send her qubit to Bob? See the Quantum Teleportation zine to find out!

## FIND MORE QUANTUM COMPUTING ZINES HERE:

<https://www.epiqc.cs.uchicago.edu/resources/>

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