



Parity bit magic

Annotation

Jacob and Sarah recognise that it is important for computers to be able to detect if an error has occurred when data is stored or transmitted over a network such as the Internet.

They are able to demonstrate an error-correction technique using parity bits. By doing this, they:

- show their understanding of how a computer can add extra information (bits) to a file to detect errors
- show how a computer could first detect an error and then correct it.

In applying the techniques, Jacob and Sarah also demonstrate computational thinking by recognising patterns in data and by applying logical reasoning to create even parity and determine the specific place in data where an error has occurred.

Background

The class has previously learned that computers store and transmit data using patterns of binary digits, or bits (represented by 0s and 1s). They have learned how numbers and text are represented using bits. They have discussed the importance of making sure that data is accurate when it is stored or transmitted and have explored some of the consequences that incorrect data storage or transmission could have in their daily lives. They have also discussed ways in which errors are detected by computers using examples from the check digits on bar codes. As a group, the students participated in a “parity magic trick” activity so that they could determine how a computer might use parity bits to detect and correct errors.

Task

Mr Liu prepares a Google™ slideshow template and asks the students to work in pairs to respond to three questions to demonstrate their understanding of how to detect and fix computer errors using parity bits. They are required to:

- explain what can go wrong when a computer is saving or sending files
- explain why a computer needs to know if there is a problem and give examples of what can happen if it can't detect errors
- demonstrate how a computer uses parity bits to detect errors.

The task requires the students to use their knowledge of discipline-specific language to communicate their understanding.

Student response

The following screenshots are from Jacob and Sarah's slideshow. The blue text shows their responses.

What can go wrong when a computer is saving or sending files?

Lots of different things can go wrong when a computer stores a file or when we try to send a file over the internet. Here are some things that can go wrong.

- Sometimes there might be something wrong with the hardware, like a bad part of a disk, or a scratch on a DVD.
- Sometimes there might be a problem with the wifi at school because too many people are on it and the computer can't send everything in the file.
- Sometimes there might be a problem with a barcode, like it is scratched, when you buy at the store or check out a book at the library.
- Sometimes an eftpos card doesn't work anymore after it was near a magnet.

Why does the computer need to know if there is a problem? What can happen if the computer can't detect errors?

The computer needs to know if there is a problem because otherwise our files would be wrong or maybe they won't open. A message we send might be garbled up and our friends would get the wrong message or couldn't read it. We might be charged the wrong price for something we buy. We might get in trouble at school for not returning a book that we never checked out!

Using parity bit cards, with your partner show how a computer uses parity bits to detect errors. Use photos and notes to explain your thinking.



A computer stores all our files in patterns of on's and off's - these are the bits. The black is off and the white is on. This shows the pattern for storing a pretend file.

Using parity bit cards, with your partner show how a computer uses parity bits to detect errors. Use photos and notes to explain your thinking.



The computer adds another on or off to each row and column to help it know if there are any mistakes in the files.

First the computer needs to make all the rows have an even number of black bits.

The computer uses the extra bits to decide if there has been an error in a bit.

We added a bit card to rows 1 and 3 to make sure all the black off bits were even numbers.

Using parity bit cards, with your partner show how a computer uses parity bits to detect errors. Use photos and notes to explain your thinking.



We did the same thing for the columns by adding an extra row to the bottom.

We added a bit card to columns 2 and 4 to make sure all the black off bits were even numbers.

Using parity bit cards, with your partner show how a computer uses parity bits to detect errors. Use photos and notes to explain your thinking.



We got someone to deliberately flip one of the parity bit cards when we weren't looking, to create an error. We figured out which one it was by looking at the parity bit cards.

We figured out that this is the bit that is flipped or wrong because the row has an odd number of black bits and the column has an odd number of black bits.

This is how a computer would detect an error using parity bits. It could flip the bit back the other way to fix the error.