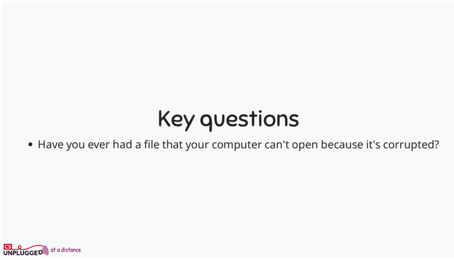
Parity Magic (Speaker Notes)

Slide 1

No speaker notes for this slide.

Slide 2

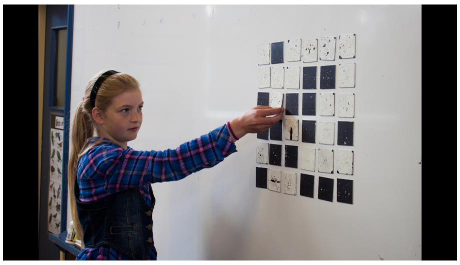
By the end of this session we'll understand how error control, error detection and error correction has improved our digital lives.



Slide 3

Who has seen the parity trick before?

If a participant does know the trick, they can help you to present this trick.



Slide 4

Here we have some data in a 5 by 5 grid of cards. I'm going to make it more difficult for myself by adding another row and column to it.

The information represented in this grid is 'binary data' because it uses two values (black and white) to represent information. The cards here have two sides, so we can represent a binary value by choosing which way up to put the card. This data might be some text, or it might represent students' grades, or anything stored on a computer. In reality this grid is just some random values, but let's imagine that it is some important data that we're relying on.

Change the cards to the following, starting in the top right and going clockwise: ⬛ Black, ⬛ Black, ⬜ White, ⬛ Black, ⬛ Black, ⬜ White, ⬜ White, ⬛ Black, ⬜ White, ⬜ White, ⬛ Black. Then click 'Flip a bit'.

Now we are simulating transmitting the information and one bit gets changed. The interactive has changed a card from black to white or white to black. I'm going to see if I can work out which bit was changed.

Determine which bit has been changed by finding the bit at the intersection of the row and column which have an odd number of black squares.

I've found it! It's this one.

Click on the appropriate bit and move the cursor to point to the green writing that should appear to the left of the interactive to confirm you were correct.

So what happened? How did I do that so quickly?

Click the 'Start Over' button.

Firstly, when I said I was going to make it harder, I was actually making it easier by putting the data into parity. Write in the chat what parity means to you.

Wait for some responses, if there aren't any responses prompt by asking what the mathematical term for pairs is (even amounts).

Let's take this step by step. What state does F1 need to be in (white or black) to create even parity, an even number of black cards in row 1? Type in the chat a "B" if you think black or "W" for white if you think white.

Wait for a couple of responses and respond accordingly. Continue this for the remainder of column F, except the last bit in the bottom right corner. Check that people aren't racing ahead for each co-ordinate by asking participants to keep pace with you.

Now let's look at the columns, starting with A6. Type in the chat a "B" if you think black or "W" for white if you think white to make column A have an even number of black bits.

Continue for columns B to E.

And what about F6? This is where we check we have completed the grid correctly, as the F column is the column we added to make all the rows have even parity. What colour card do we need to complete row 6? And what colour card do we need to complete column F?

Wait for a few responses.

That's right, it's the same colour to finish both row 8 and column H. If it does work out the same when you're doing this with a class, then you can be confident that the other cards were put in correctly. If it doesn't, you'll need to check back and see if one of the cards you've added is wrong.

Let's get the computer to flip a bit.

Wait for the “Confusation” to happen - the interactive will flip one card from black to white or white to black.

Note: For this next section, that you can click a row or column label in the interactive to 'circle' the row or column when talking about it.

With your knowledge of parity, can you find the card that was flipped? Write in the chat the grid reference for the flipped card.

Allow time for responses in chat.

Let's check the suggested bit.

Click on the letter of the column suggested. This will put a red rectangle around the selected column of bits.

We can see that this column has an uneven number of black bits, so we know one of these bits has been changed. Lets go check the row.

Click on the number of the row suggested to bring up another red rectangle.

We can see that this row also has an uneven number of black bits. So we know the bit at the intersection of these two red rectangles is the bit that was changed. Let's click on this bit and see if we were right.

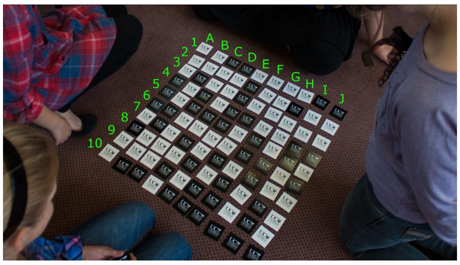
Click on the card and see if you are correct.

Slide 5

Here are some students who created some binary data in a different time and place, but one of the cards has been flipped. This reinforces the point that we can't go back and ask the students which card was flipped, but we can work it out because they have added a parity row and column of cards.

Slide 6

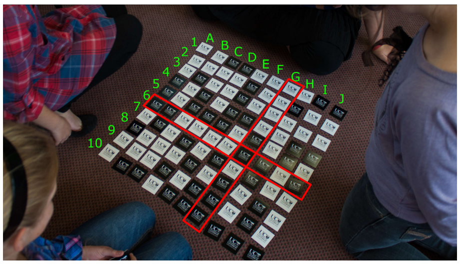
> Can you figure out which one to flip to get the correct original data? Share which one you think it is in the chat.



What for a few responses in the chat. This could take a while! If they need some help, you could ask them to just give the row or column separately as they find them.

Slide 7

> This image shows that the answer is G6.



Leave this slide up for a few seconds so participants can count the cards in the highlighted row and column themselves.

> Does the grid in this image follow the same rule?

Wait for a few responses, either in the chat, or from people nodding.

> We sometimes hear about pay parity, gender parity, currency parity, which is when two currencies are worth the same amount. You may have even heard of number parity, which is whether a number is odd or even (for example, the parity of 5 is odd).
>
> The word parity comes from the same Latin root as pair, which is pār, meaning 'equal'. An everyday example of parity is pairs of socks. You can't make pairs out of 5 socks, even if they are all the same!
>
> In this case, the cards were set up a long time ago and in a different place, yet you could still fix the error. This reinforces the idea that a computer doesn't need to have seen the information before to be able to find and correct errors.

Slide 8

Here are some supporting resources for you. I'll paste these links in the chat.

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CS Unplugged - Error detection and correction topic
https://www.csunplugged.org/en/topics/error-detection-and-correction/

Computer Science Field Guide - Parity interactive
https://www.csfieldguide.org.nz/en/interactives/parity/

Example of teaching Parity in person
https://vimeo.com/437726658

Supported home learning
https://www.csunplugged.org/en/at-home/mind-reading-magic/

MOOC - Teaching Computational Thinking - Section 5
https://www.edx.org/course/teaching-computational-thinking
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