institute of CODING

Queen Mary University of London

The Magic of Computer Science (Part I)

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teachinglondoncomputing.org/magicofcs/

Please register at

bit.ly/CS4FN-MAGIC1

Computer Science is about computation (not computers)

- Computational thinking is a way of solving problems you learn as a computer scientist

Magic = Computation

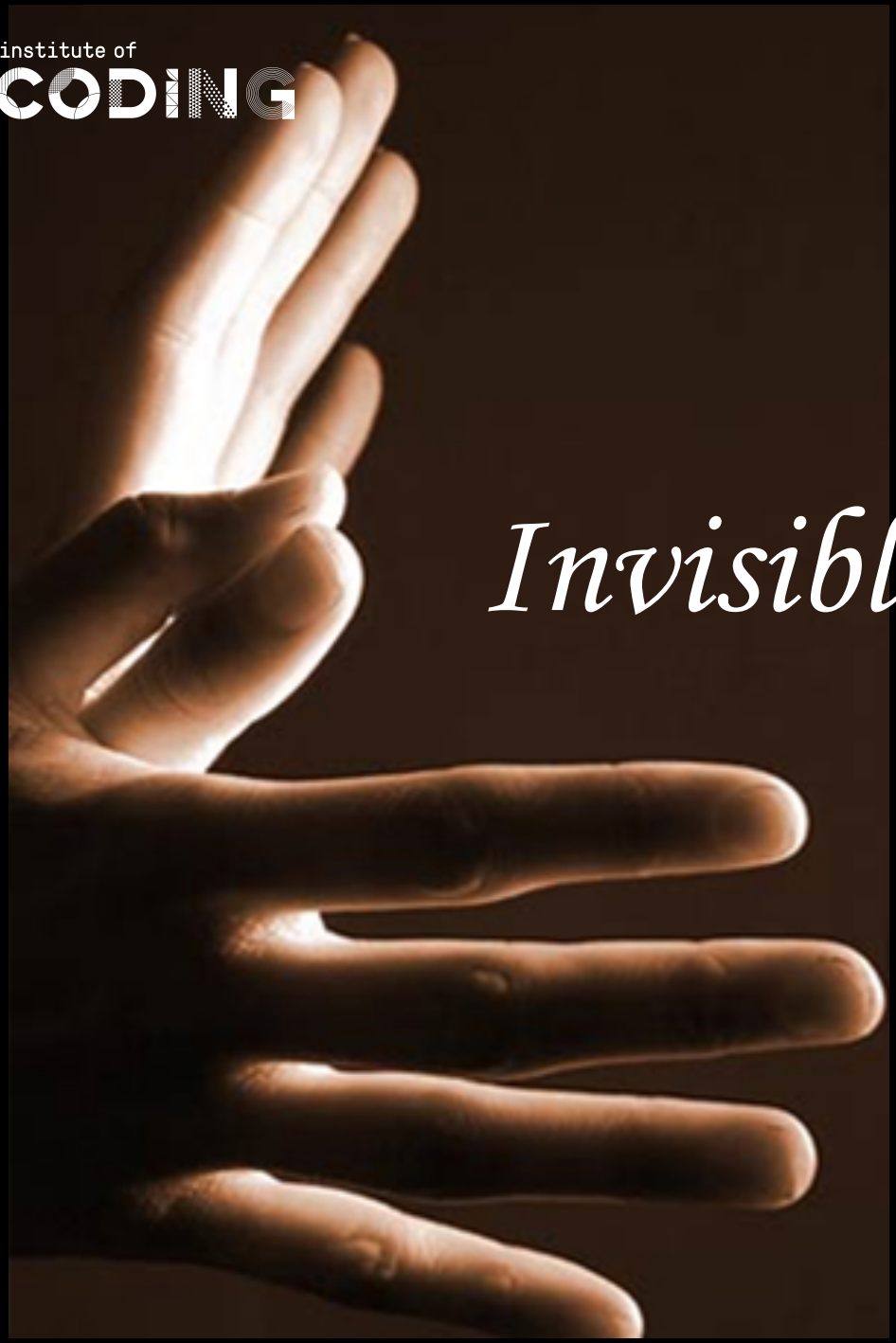
- Magic is based on science, maths and engineering.
- It is computation.

- Magicians and Computer Scientists think the same way

Computational Thinking

On to the magic …
Please keep the secrets

- I'm going to teach you to do the tricks
- If you do perform them later for friends don't break the magician's code
- If you do know then don't shout out
  - let others puzzle it out first!



Invisible Palming

Ponder break

How on earth do they do that?

The magical instructions

1. Put two cards between each finger of the volunteer saying “2 cards make a pair”
2. Place the final card alone
3. Collect them up a pair at a time splitting the pairs into two piles
4. Ask the volunteer to choose where to put the extra single card
5. Put the card there
6. Pretend to move it invisibly from one pile to the other
7. Deal cards from pile 1 in pairs showing the extra card has gone
8. Deal cards from pile 2 in pairs showing the extra card is there

It's an algorithm
That's all programs are too

- An algorithm is:
  - Instructions to be followed in order
  - that do something you want done
- Programs are:
  - Algorithms for computers to follow
- Magic tricks are:
  - Algorithms for magicians to follow

Activity 2

- In the Google doc
  bit.ly/CS4FN-MAGIC1
  write down what you think

ALGORITHMIC THINKING
is.

Algorithmic Thinking is:

- Thinking of solutions AND other situations as algorithms
  - steps to blindly follow
    - to guarantee a result
    - to get answers
    - to simulate a situation
    - to run experiments

Algorithmic Thinking is:

- Devising algorithms
  - Making sure it always works
  - Thinking through ALL possibilities
  - Attention to detail

- Writing the instructions in a precise language

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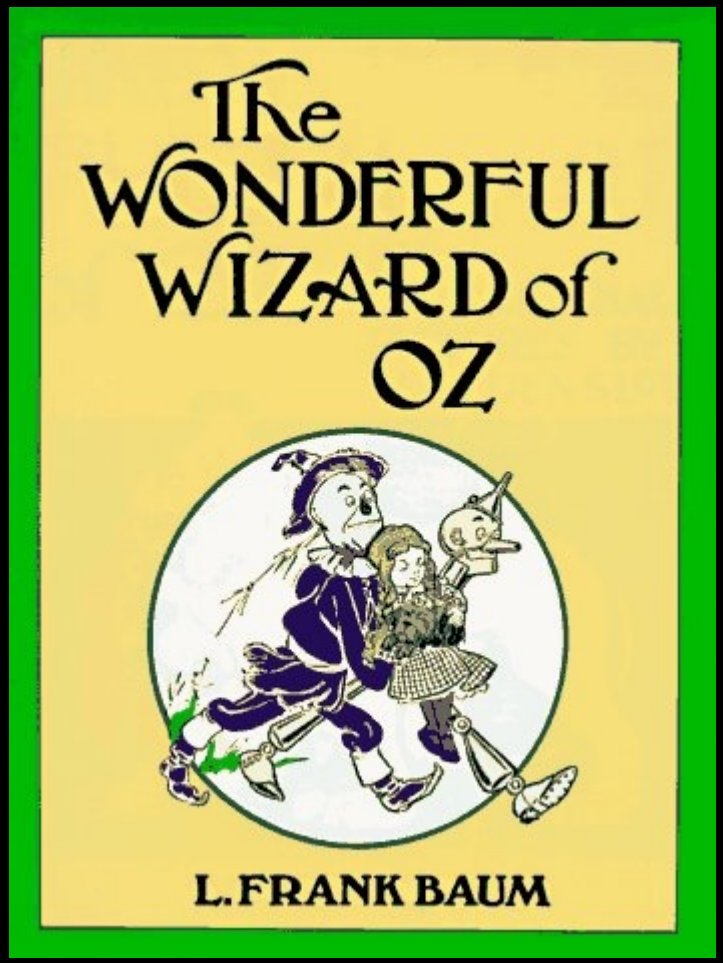
Programmers really are wizards!

Magic = algorithm + presentation

Software = algorithm + presentation

Both the algorithm and the presentation (the interface) must work well

The Magical Wizardly Book

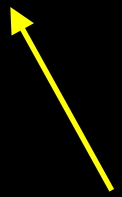


Magical Books

- Wizardly books have magical powers.
- Books like ‘The Wizard of Oz’ and ‘Macbeth’ can control your mind!

The start of The Wizard of Oz

Dorothy lived in the midst of the great Kansas prairies, with Uncle Henry, who was a farmer, and Aunt Em, who was the farmer's wife.



Circle a word from the first sentence of the Wizard of Oz

Dorothy lived in the midst of the great Kansas prairies, with Uncle Henry, who was a farmer, and Aunt Em, who was the farmer's wife.

Circle a word from the first sentence

Their house was small, for the lumber to build it had to be carried by wagon many miles.

Repeatedly count the number of letters and then jump on that many words and circle the new word

There were four walls, a floor and a roof, which made one room; and this room contained a rusty-looking cooking stove, a cupboard for the dishes, a table, three or four chairs, and the beds.

Stop as soon as you hit a red word

Ponder break

How on earth do they do that?

It always works… (of course!)

- You will always end up at that word
- It actually works for just about any book…
  - if you keep going far enough

The magic algorithm…

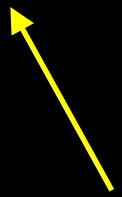
- Circle a word from the first sentence.
- Repeatedly
  - Count the number of letters in it.
  - Jump forward that many words.
  - Circle that word.

  stopping when you hit a red word

Let’s see how it works by looking at Macbeth

The start of Macbeth

When shall we three meet again
In thunder, lightning, or in rain?



Circle a word from the first sentence of the Macbeth

When shall we three meet again
In thunder, lightning, or in rain?

Circle a word from the first sentence

When the hurlyburly's done,
When the battle's lost and won.
That will be ere the set of sun.
Where the place?

Repeatedly count the number of letters and then jump on that many words and circle the new word

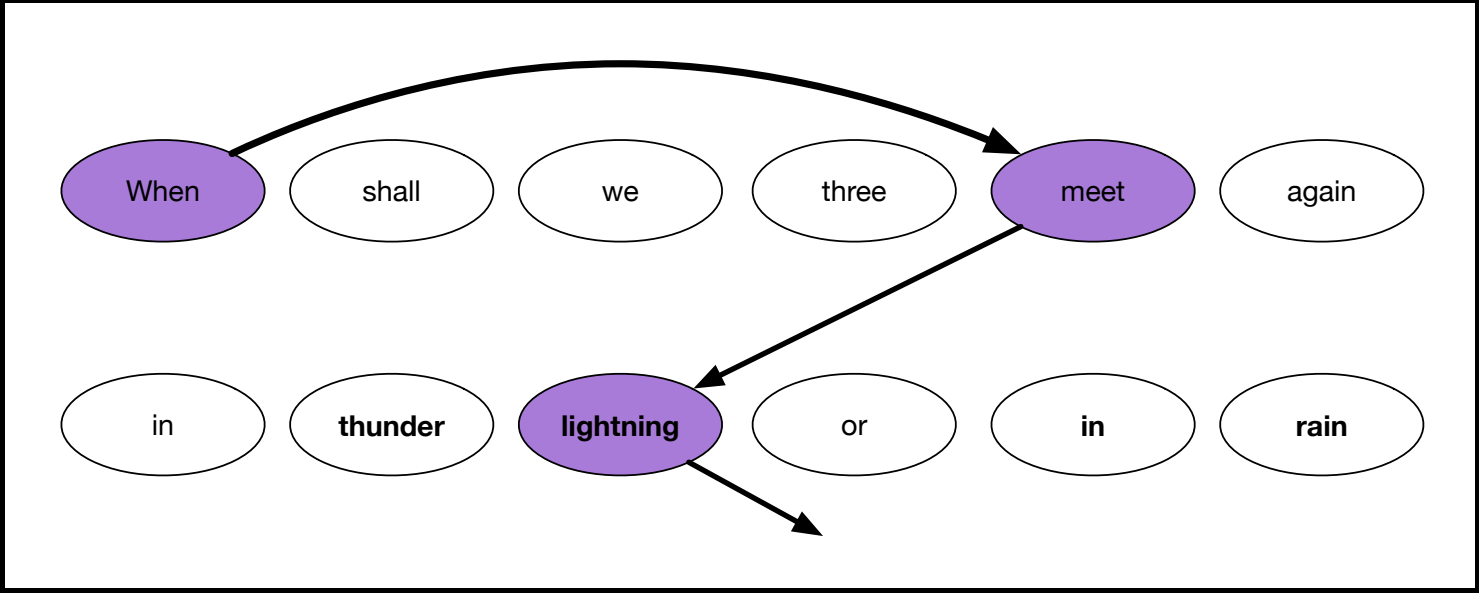
Upon the heath.

There to meet with Macbeth.

Stop as soon as you hit a red word

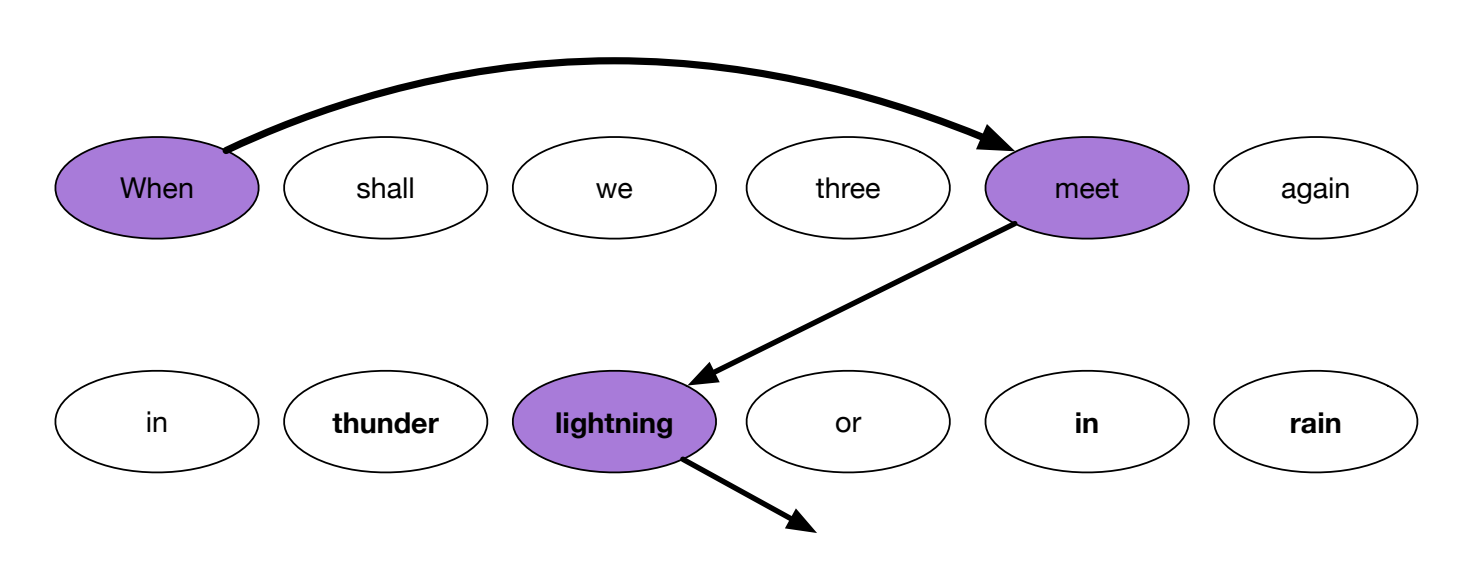
Activity 4

- Either do this with pencil and paper OR
- Go to the Google Doc (bit.ly/CS4FN-MAGIC1) for a link to an online drawing package drawing



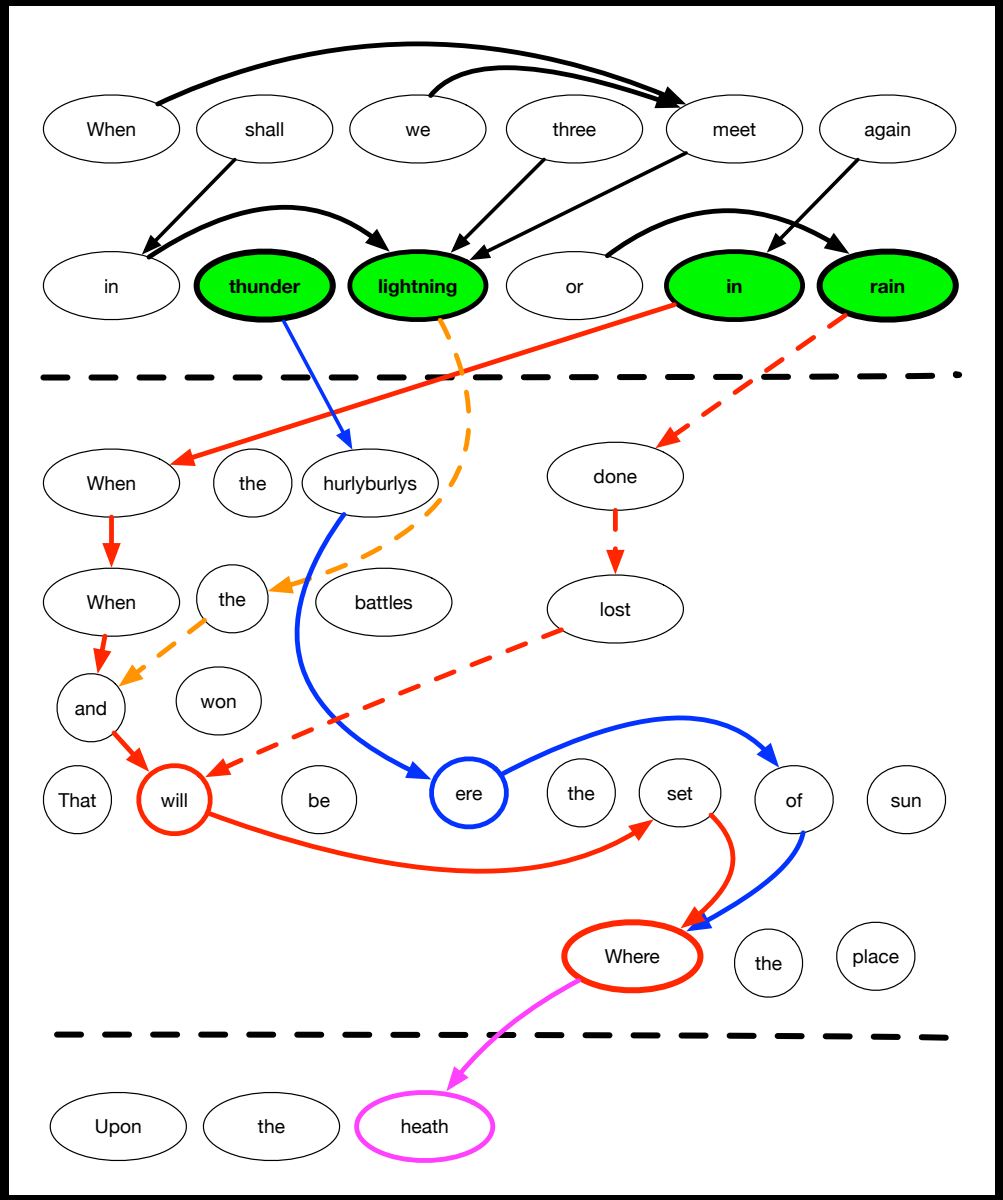
How can we be sure?

- We need to check it ALWAYS works
  - in a way so we can DOUBLE CHECK
- DRAW ARROWS to show the jump from word to word (until you get to a red word).

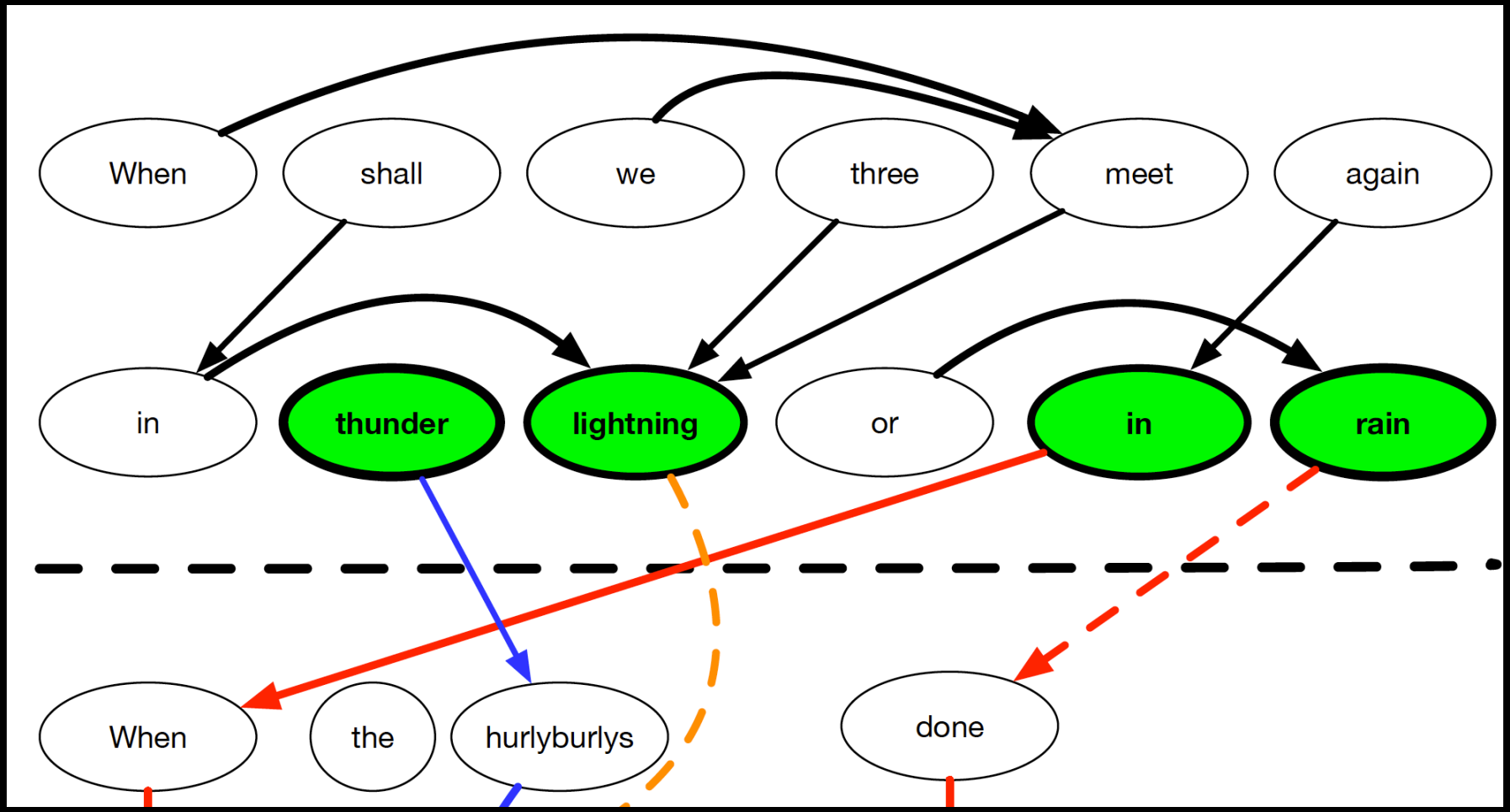


- Do it for every word in the FIRST sentence.

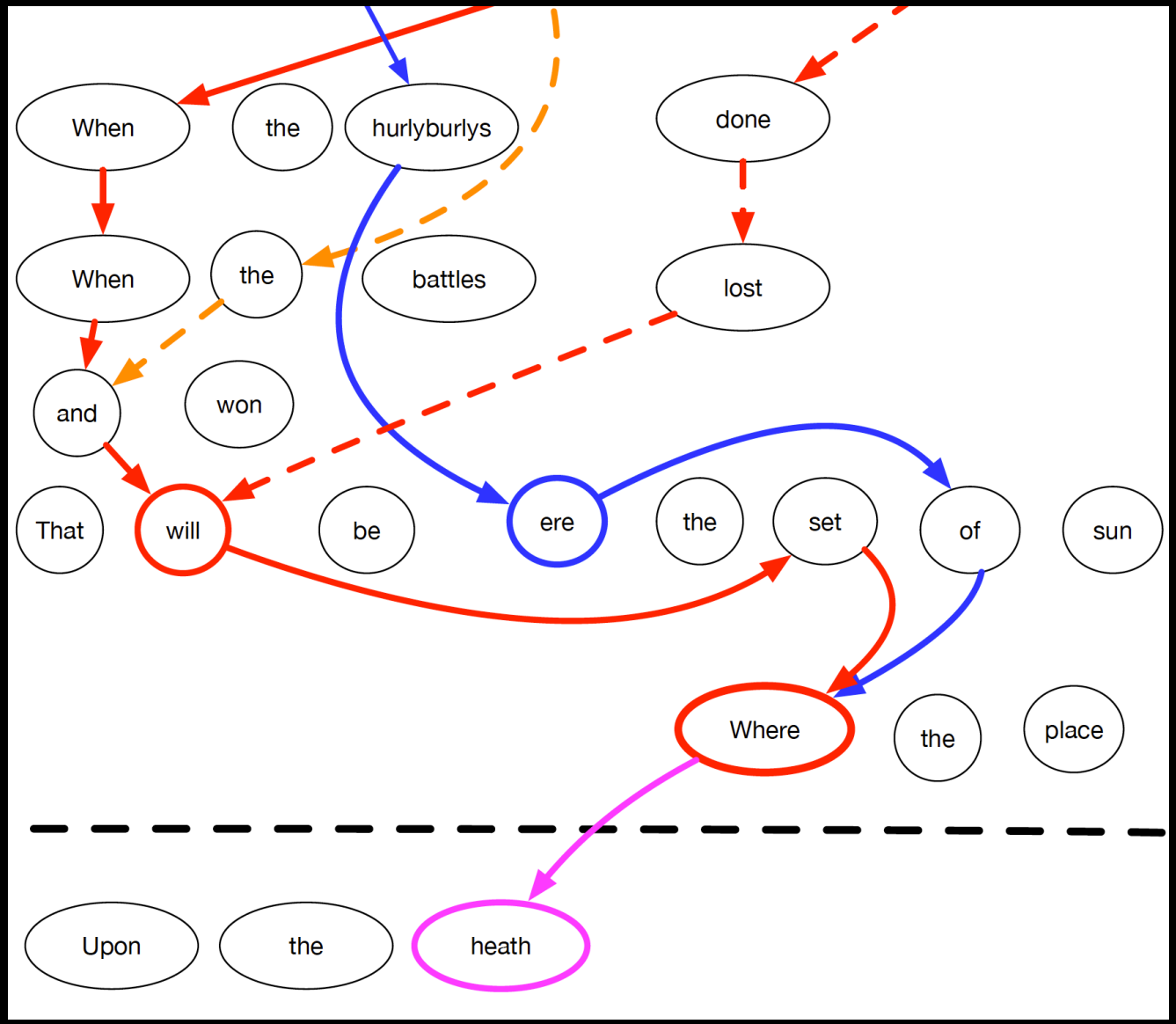
Showing it always works



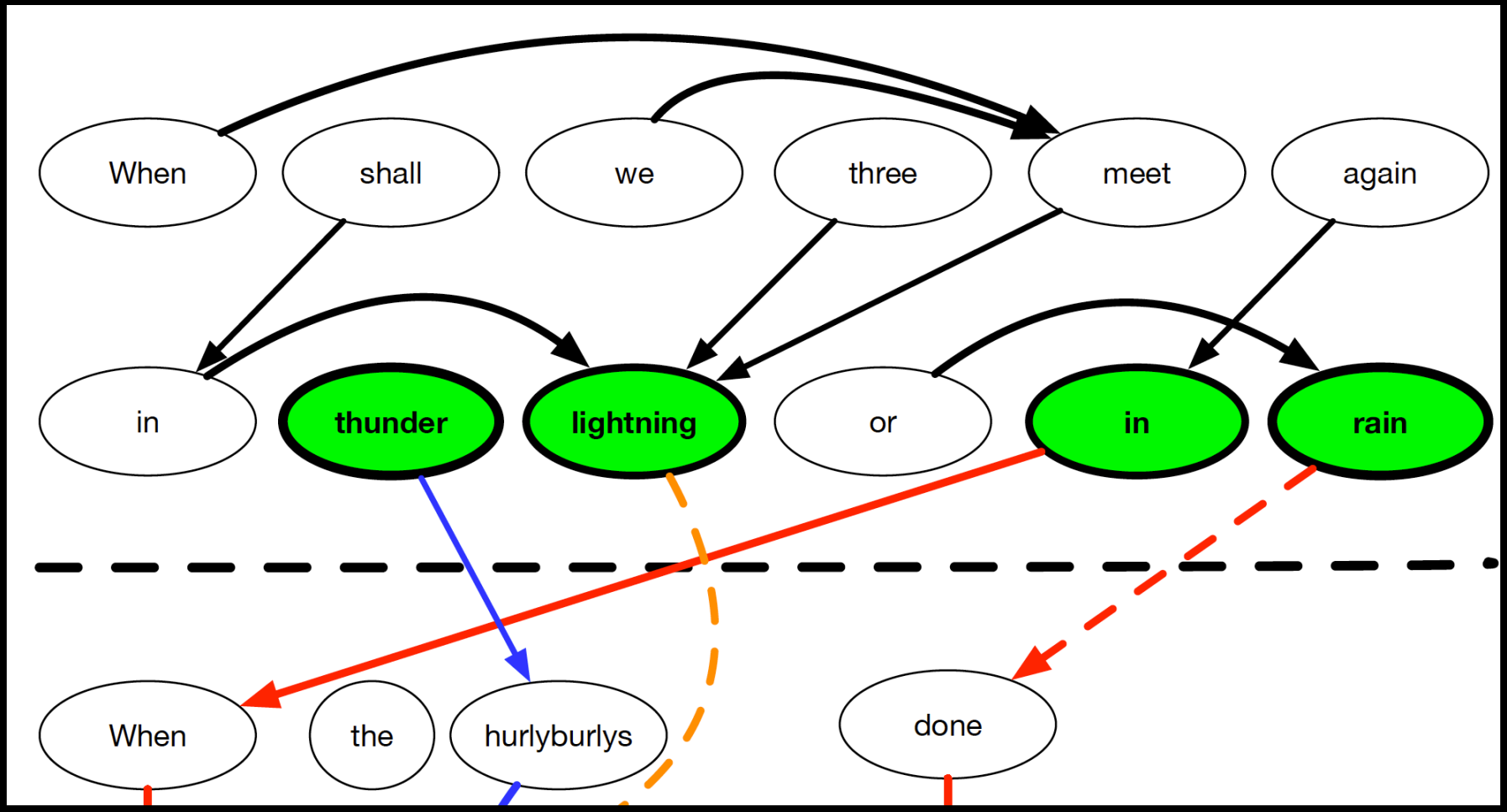
Not as many paths as you thought!



Merged paths stay merged



Logical Thinking



Evaluation

- We have checked the algorithm *always* works.
- This is the part of computational thinking called EVALUATION
- Do the same for programs
- Important to check all possibilities.
- Both magicians and computer scientists have to think clearly and precisely.

- Check The Wizard of Oz always works too.

Testing v Logical Thinking

You can evaluate an algorithm by trying to test every path through it

Or you can use logical thinking to cut down the amount of testing needed.

Programmers really are wizards!

Magic = algorithm + presentation

Software = algorithm + presentation

- Programmers and magicians have to think in the same way
  - creating new tricks,
  - creating new programs

Design for people making mistakes

- EVERYONE makes mistakes
- Design programs to help people avoid the problems!

Computational thinking is problem solving for people!

Thank you

Please fill in the feedback form at the end of the Google Doc

bit.ly/CS4FN-MAGIC

Resources on magic and computer science at:

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