PDST
Professional Development Service for Teachers
An tSeirbhís um Fhorbairt Ghairmiúil do Mhúinteoirí

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Department of Education and Skills

National Workshop 3

LEAVING CERTIFICATE
COMPUTER SCIENCE

Key Messages

- Leaving Certificate Computer Science aims to develop and foster the learner's creativity and problem solving, along with their ability to work both independently and collaboratively.
- Computing technology presents new ways to address problems and computational thinking is an approach to analyse problems, design, develop and evaluate solutions.
- The ALTs provide opportunities for students to develop their theoretical and procedural understanding of the course.
- The externally assessed coursework will be based on all learning outcomes, with those of strand 3 being particularly relevant.
- Digital technologies can be used to enhance collaboration, learning and reflection.

Schedule – Day 2

9.30am - 11.00am	*Session 4:* Computational Thinking
	Break
11.30am - 1.00pm	*Session 5:* Algorithms 1
	Lunch
2.00pm – 4.00pm	*Session 6:* Computer Systems 1 LCCS Promotion Conclusion and Evaluation

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NW3 Session 4

Computational Thinking

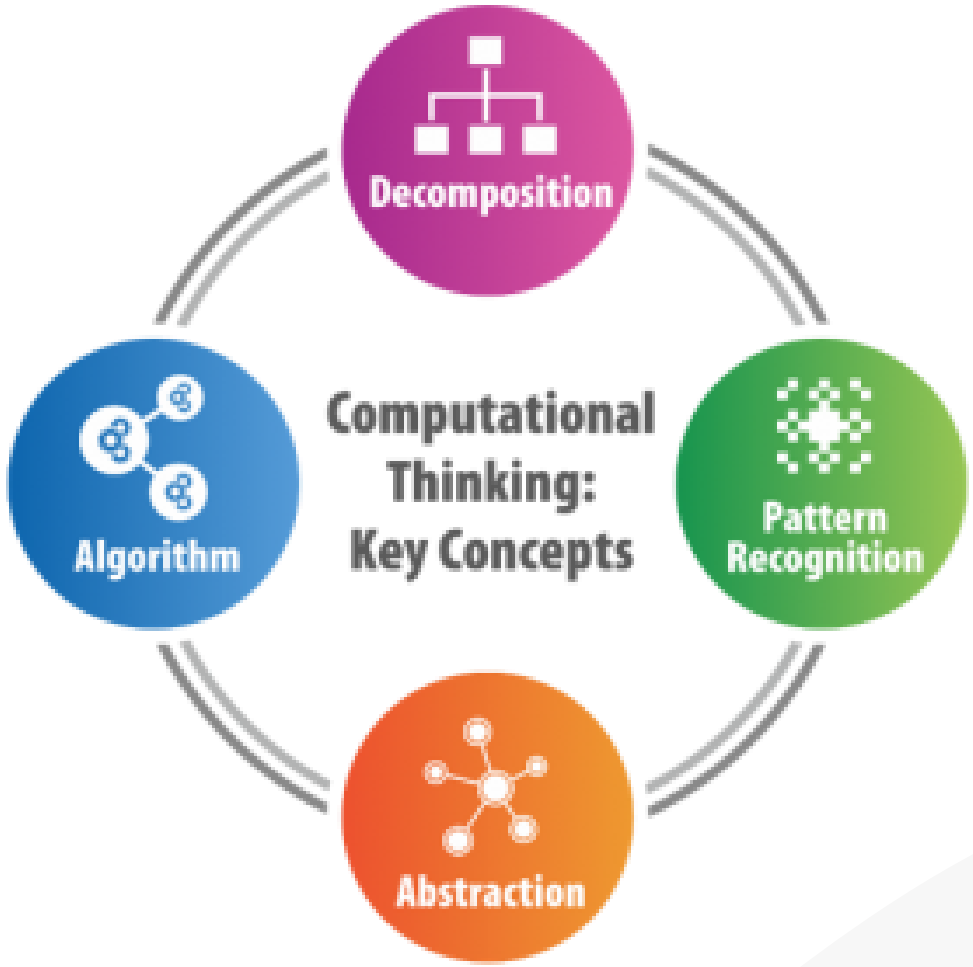
Learning Intentions

By the end of the session, participants will be enabled to:

- **Work in groups on problem solving.**
- **Develop their understanding and experience in using some of the pillars of Computational Thinking.**
- **Assess and analyse research in the area of CT.**

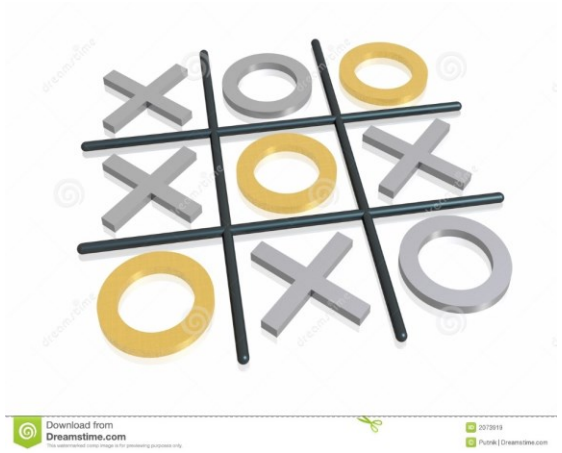
One Model sees Computational Thinking being made up of four parts:

- Decomposition.
- Pattern recognition.
- Abstraction.
- Algorithm design.

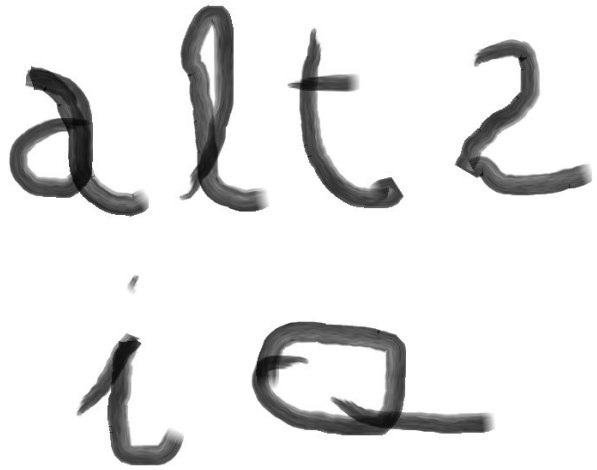


Part 1
Warmup Activities

How do you TC?



Xs and Os



Others:

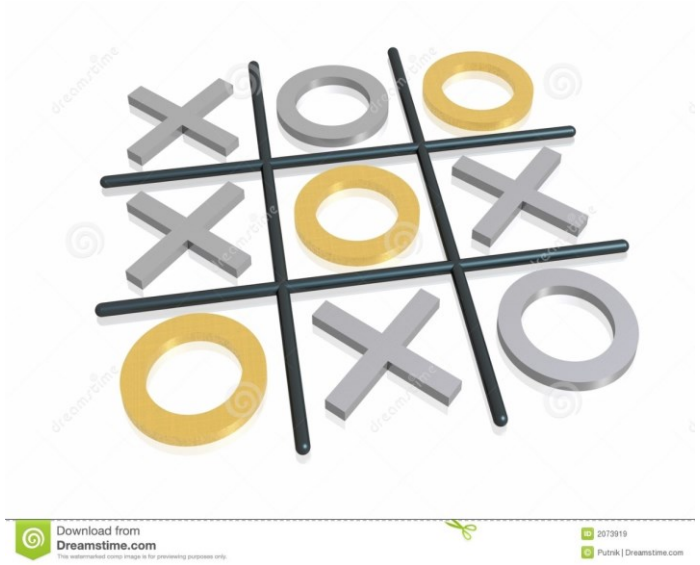
Music – 3 chord trick

Chalice problem – NCCA
Google CT

CT Channel on Slack – start in a thread

Xs and Os –Developing a winning strategy

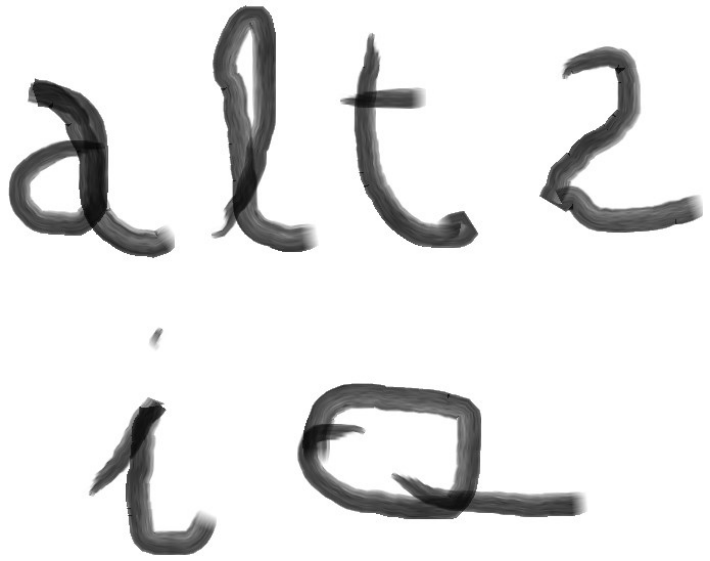
Which pillars of Computational Thinking are used?
Abstraction? Decomposition? Pattern Recognition? (Monte Carlo?) Algorithm formation?



.Interactive online version:

https://www.turtlediary.com/game/tic-tac-toe.html

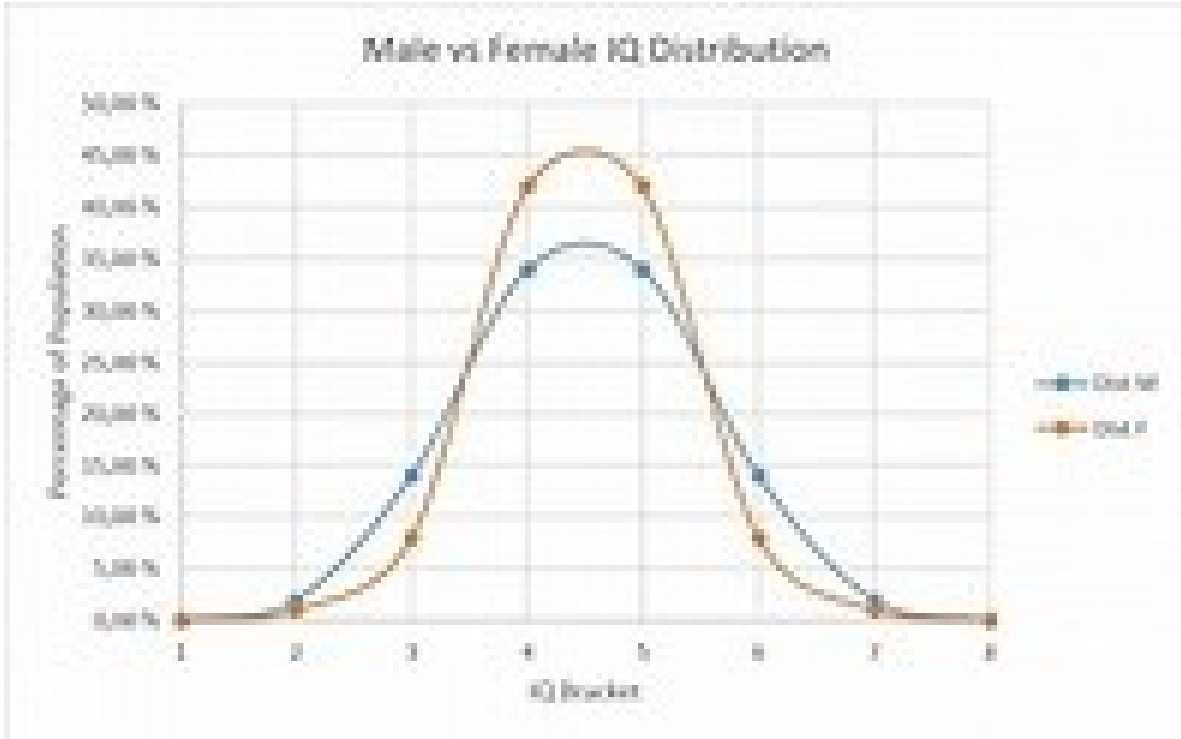
ALT2 – Mean and Median



<u>IQ: Females are more intelligent than males</u>:

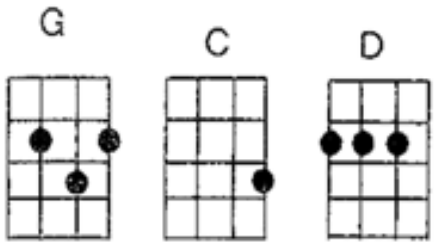
Mean, median, mode …

Use abstraction, decomposition, pattern recognition…



Music – 3-chord trick

Robert Zimmerman



G C G C G D
How many roads must a man walk down, before he is called a man? *
G C G C D
How many seas must the White Dove sail, before she sleeps in the sand? *
D G C G C D
And how many times must a cannonball fly, before they are forever banned?

D C D G C
The answer my friend, is blowin' in the wind,
C D G
The answer is blowin' in the wind.

Music – 3-chord trick – Changing key

A	B	C	D	E	F	G		

3-chord trick – pick a letter (no 1) – choose no 4, 5.
So for A, the other two are D, E

What are the other 2 chords for C?
And for G?

Unplugged activity – give the general solution to change key.

Part 2

Computational Thinking – Thoughts and Models

Some Thoughts

Way of understanding problems

Empowerment

Licence to act

Helping hand

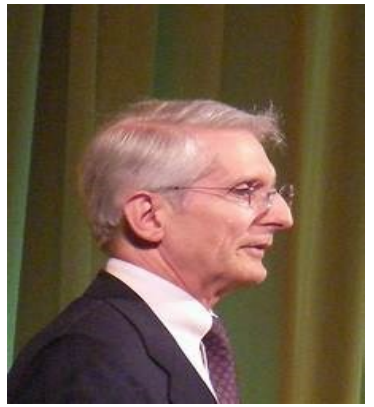
Not formulaic?

Fixed vs growth mindset (Dweck)

Jeanette Wing

"Computational thinking is the thought processes involved in formulating problems and their solutions so that the solutions are represented in a form that can be effectively ***carried out by an information-processing agent***."

Peter Denning



Computational thinking (CT) is a popular phrase that refers to a collection of computational ideas and habits of mind that people in computing disciplines ***acquire through their work*** *in designing programs, software, simulations, and computations performed by machinery.*

Computational Thinking – Tips / Guide

Click here for definitions / tips from Google

Automation, Data Representation, Decomposition, Parallelization, Simulation…

Paul Curzon's Intelligent Piece of Paper has some interesting tasks around Computational Thinking.

Other thoughts: Components of Computational Thinking

1. Abstraction, Algorithms, Automation, Problem Decomposition, Parallelization, Simulation
   Barr & Stephenson (2011)

2. Abstraction, Automation, Analysis
   Lee et al. (2011)

3. Abstraction, Algorithmic Thinking, Decomposition, Evaluation, Generalization
   Selby & Woollard (2013)

4. Abstraction, Algorithms, Decomposition, Debugging, Generalization
   Angeli et al. (2016)

5. Abstraction, Algorithms, Automation, Problem Decomposition, Generalization
   Wing (2006, 2008, 2011)

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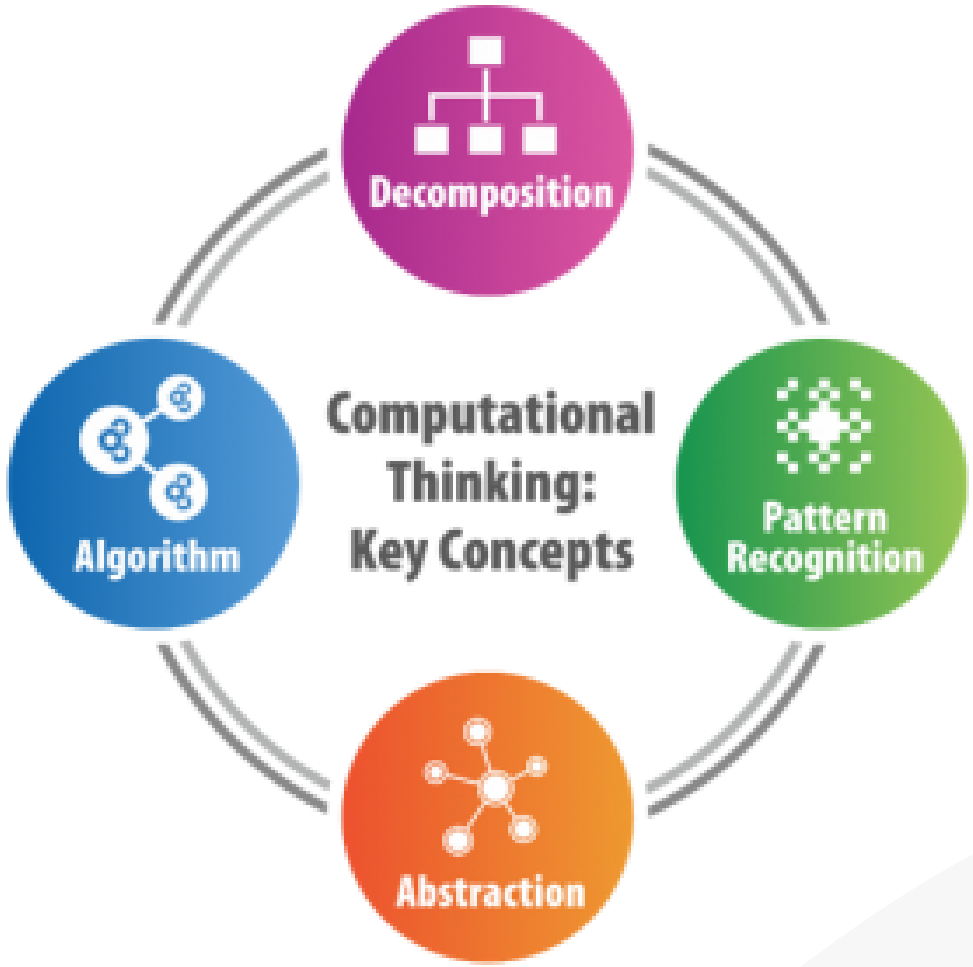


*plus experiments / trials / ‘Monte Carlo’

Part 3
Further CT Activities

Mining Cryptocurrencies – Factors of Semi-Primes

Semi –prime number only has two other factors, apart from itself and 1 (eg 35)

Finding the factors of (really big) semi-primes was one way to harvest cryptocurrencies

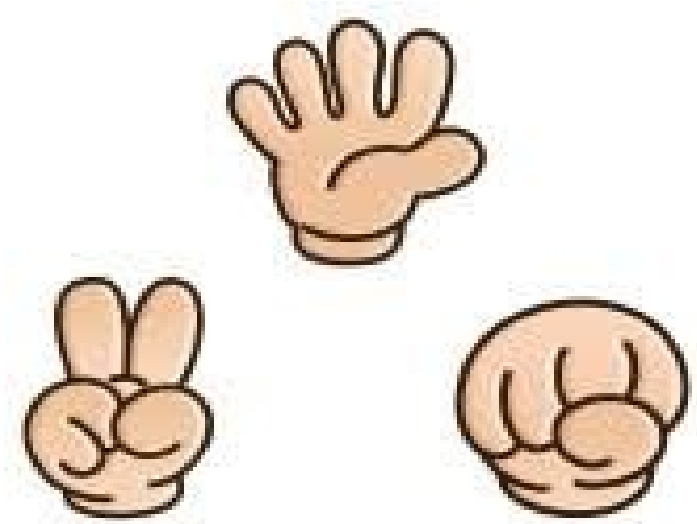
323 is a semi-prime – what are the factors (in Chat)

Develop a general solution (English and/or pseudocode and/or coding) to semi-prime problems

Use Computational Think to enhance your solution

(Remember the semi-primes are huge – hundreds of digits so efficiency is important)

RPS



ROCK, PAPER, SCISSORS

1. Write code / pseudocode to determine the winner.

1. Make the code more efficient.

1. Develop a winning strategy

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