

Review 1

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Topics Covered

- Informatics and Data Science

Problem Solving with Thinking	Problem Solving with Computer Science
Computational Thinking	Variables
Design Thinking	Conditionals (Selection)
Creative Thinking	Loops (Repetition)
Statistical Thinking	Arrays
	Standard I/O, File I/O

Thinking: Computational Thinking

- Fundamental to problem solving
- Decomposition
- Abstraction
- Generalization
- Pattern Recognition
- Algorithmic Thinking
- Evaluation

Thinking: Computational Thinking

- Fundamental to problem solving
- What are the six skills that we discussed?
- Will you be able to apply them?
- Will you be able to recognize them in action?

What is Computational Thinking?

- A way of thinking for *logically* and *methodically* solving problems
 - E.g., *purposeful, describable, replicable*
- Includes *skills* such as
 - Decomposition
 - Pattern Recognition
 - Abstraction
 - Generalization
 - Algorithm Design
 - Evaluation

Thinking: Design Thinking

- What are the four key steps?
- Will you be able to apply them?
- Will you be able to recognize them in action?

Design in its most basic form is a process, an action, a verb not a noun. A protocol for solving problems and discovering new opportunities. Techniques and tools differ and their effectiveness are arguable but the core of the process stays the same. It's taken years of slogging through Design = high style to bring us full circle to the simple truth about design thinking. That it is a most powerful tool and when used effectively, can be the foundation for driving a brand or business forward.

Basically Design thinking consists of four key elements.

1: Define the problem

Sounds simple but doing it right is perhaps the most important of all the four stages. Another way to say it is defining the right problem to solve. Design thinking requires a team or business to always question the brief, the problem to be solved. To participate in defining the opportunity and to revise the opportunity before embarking on its creation and execution. Participation usually involves immersion and the intense cross examination of the filters that have been employed in defining a problem.

FAST COMPANY

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From: <https://www.fastcompany.com/919258/design-thinking-what>

Thinking: Creative Thinking

- Makes practicing computational thinking more effective
 - Computational thinking makes practicing creative thinking more efficient
- What are the four competencies that we discussed?
- Will you be able to apply them?
- Will you be able to recognize them?

CREATIVE THINKING

Epstein's Generativity Theory breaks creative thinking down to four core competencies

- *Capturing* novelty
- *Challenging* established thinking and behavior patterns
- *Broadening* one's knowledge beyond one's discipline
- *Surrounding* oneself with new social and environmental stimuli



Thinking: Statistical Thinking

- What are the three types of analytics?
 - What are they for?
- What are the three main groups of descriptive statistics?
 - Will you be able to apply them?
 - Will you be able to interpret the results?
- What is correlation? How to use it to investigate/interrogate?

Basic Ideas

- Thought processes involved in statistical problem solving
 - From problem formulation to conclusions
- A four-dimensional framework for statistical thinking in empirical enquiry
 - Investigative cycle
 - Interrogative cycle
 - Types of thinking
 - Dispositions
- Central element: “**variation**”

CS: Variables

- Memory location to hold a value that can change during the execution of a program
- The assignment operator
- int, float, char, Boolean, string, array, etc.

CS: Conditionals (Selection)

- If
- If-Elif
- Nested If
- How to design your if blocks, elif blocks
- How to use compound conditionals
- Flowchart
- Step-by-Step Tracing

CS: Loops (Repetition)

- For loops vs. While loops
 - When to use which?
 - Example of a count-controlled & sentinel-controlled loop?
- Nested loops
- Flowchart
- Step-by-Step Tracing

CS: Arrays

- Data structure that has multiple values as elements
 - An array of numbers
 - An array of strings
 - ...
- The power of Loops + Arrays
- 0-indexing
- Built-in methods/functions associated with an array
- How to go through each element of an array?
- How to access elements in a 2-D array?

CS: Standard I/O, File I/O

- Standard I/O: for screen
 - `input()`, `print()`
- File I/O: program reading in files as inputs, and writing out files as outputs
- What are the benefits of File I/O?
- CSV, texts