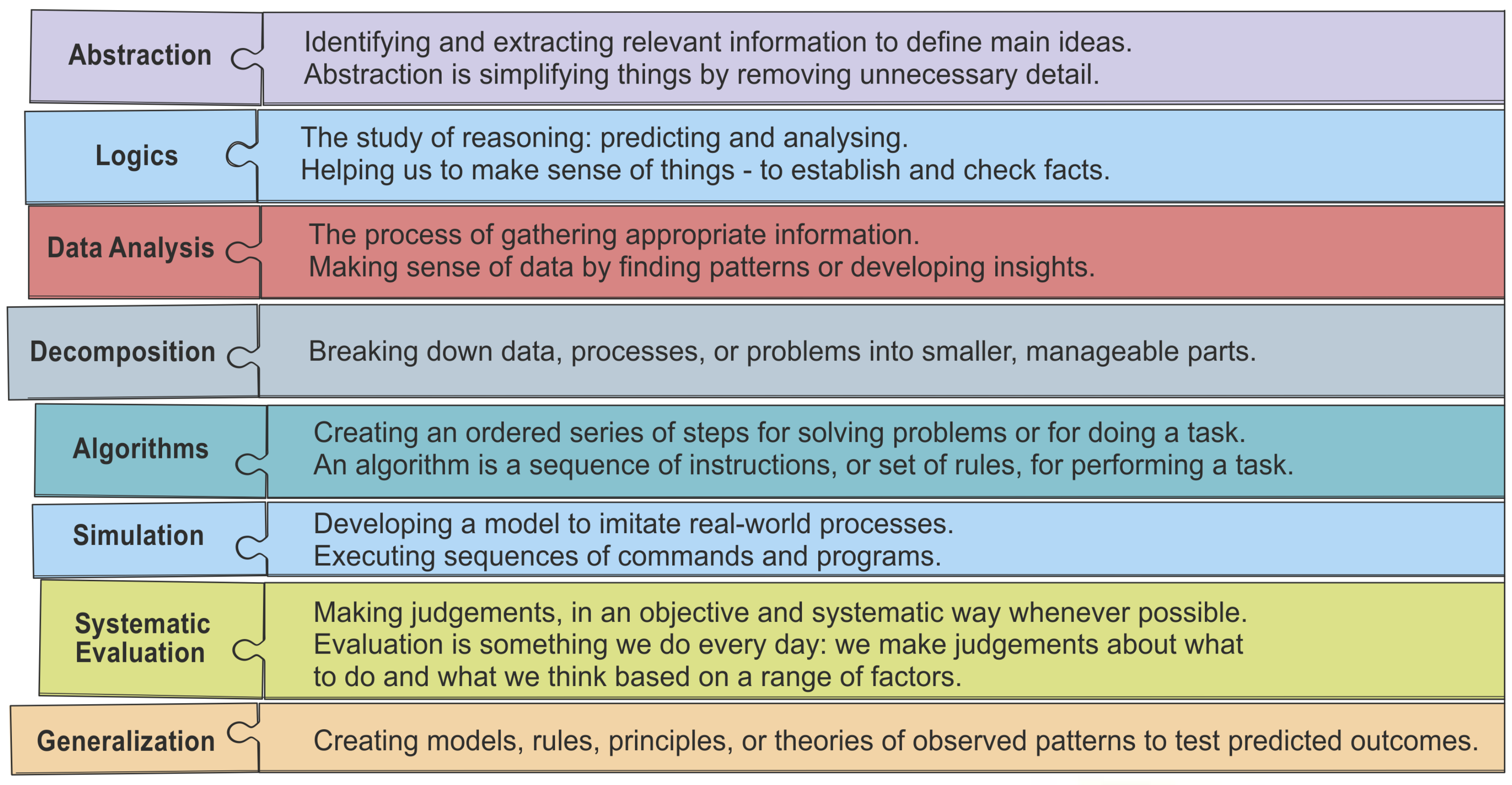
STEMkey

Teaching standard STEM topics with a key competence approach

Module Q12. Algorithms and Data

Computational Thinking



Abstraction	Identifying and extracting relevant information to define main ideas. Abstraction is simplifying things by removing unnecessary detail.
Logics	The study of reasoning: predicting and analysing. Helping us to make sense of things - to establish and check facts.
Data Analysis	The process of gathering appropriate information. Making sense of data by finding patterns or developing insights.
Decomposition	Breaking down data, processes, or problems into smaller, manageable parts.
Algorithms	Creating an ordered series of steps for solving problems or for doing a task. An algorithm is a sequence of instructions, or set of rules, for performing a task.
Simulation	Developing a model to imitate real-world processes. Executing sequences of commands and programs.
Systematic Evaluation	Making judgements, in an objective and systematic way whenever possible. Evaluation is something we do every day: we make judgements about what to do and what we think based on a range of factors.
Generalization	Creating models, rules, principles, or theories of observed patterns to test predicted outcomes.

Aim of the module

To present a conceptual and pedagogical foundation to cover digital technologies in higher education programmes, which lead to increased digital competences of future STEM teachers.

The module will provide guidelines for future teachers on how to transform teaching and learning while using ICT and delivering fundamental digital topics, which nurture the development of digital competences

The Main Pedagogical Approaches and Methods

Short lecture

* Topic introduction

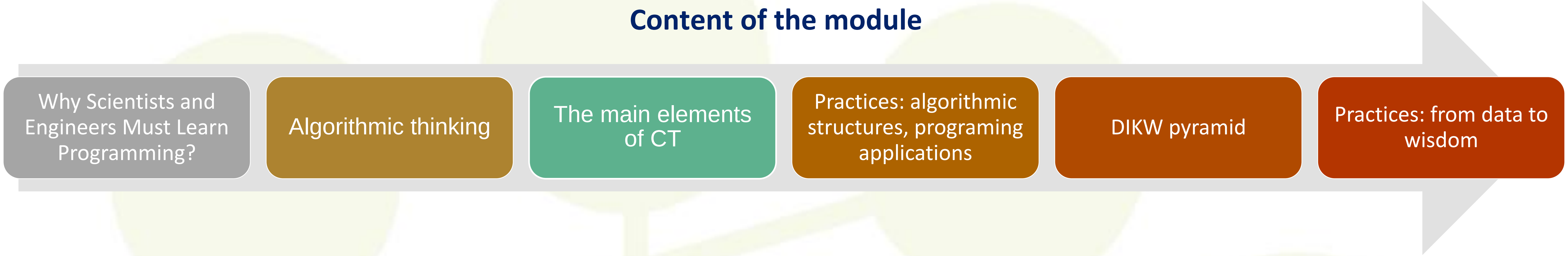
Individual and/or group work:

* Analyse of scientific papers, life examples

* Practice work on simple algorithms and data analyse

Discussions

Content of the module



Why Scientists and Engineers Must Learn Programming?

Algorithmic thinking

The main elements of CT

Practices: algorithmic structures, programing applications

DIKW pyramid

Practices: from data to wisdom

Why Scientists and Engineers Must Learn Programming?

* Work **10 times faster** by writing computer programs to automate tedious tasks.

* Programming allows you **to discover more creative solutions** than your colleagues who don't know how to program.

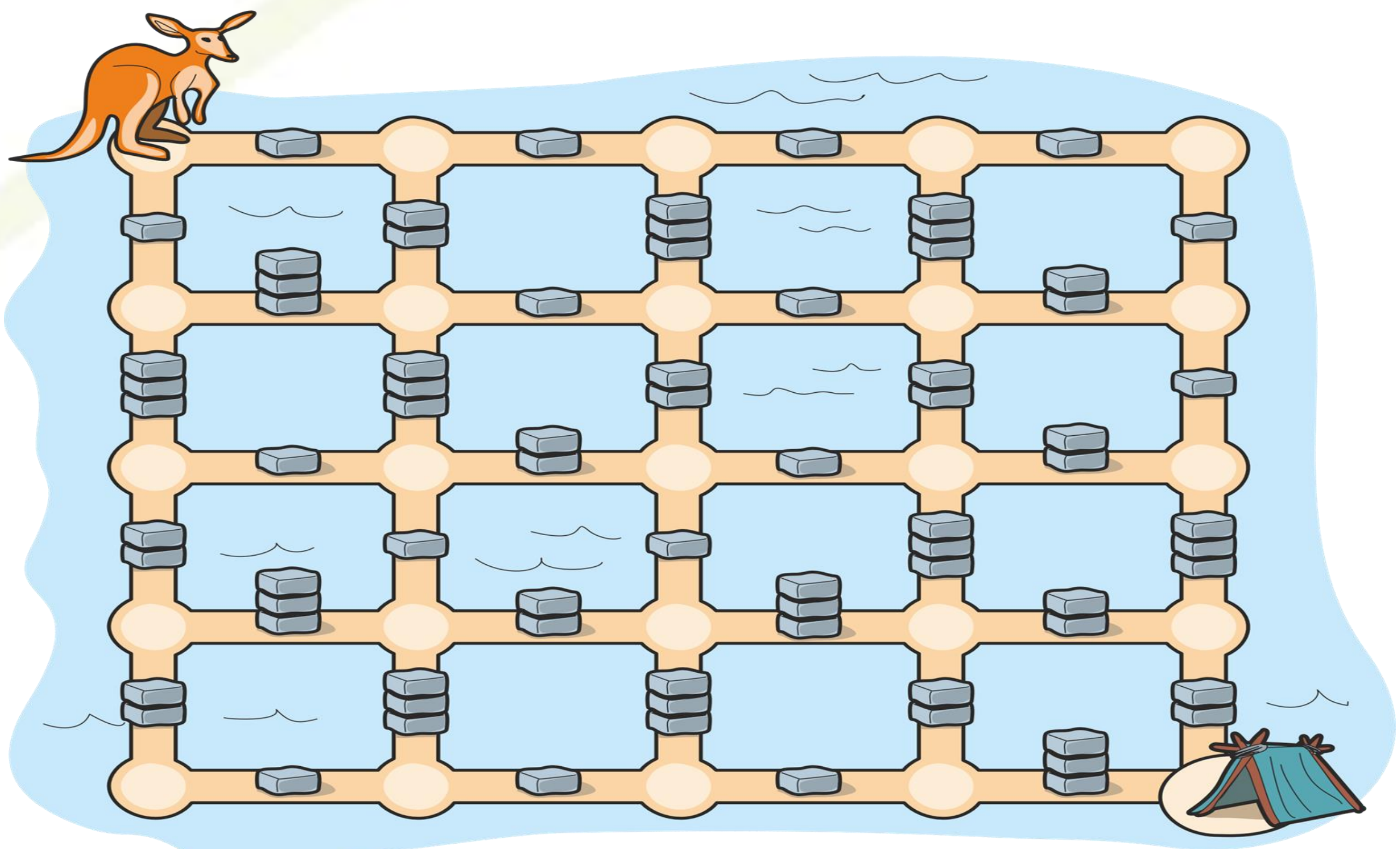
* Knowing how to program allows you **to communicate effectively with programmers** that your lab hires to do the heavy-duty coding.

Algorithmic thinking

Algorithmic thinking is a derivative of computer science and coding. This approach automates the problem-solving process by creating a series of systematic logical steps that process a defined set of inputs and produce a defined set of outputs based on these.

Jumping kangaroo

A kangaroo jumps home. She can jump only along the path, only vertically (up – down) or horizontally (left – Right) and only if there are not more than two bricks in the way.



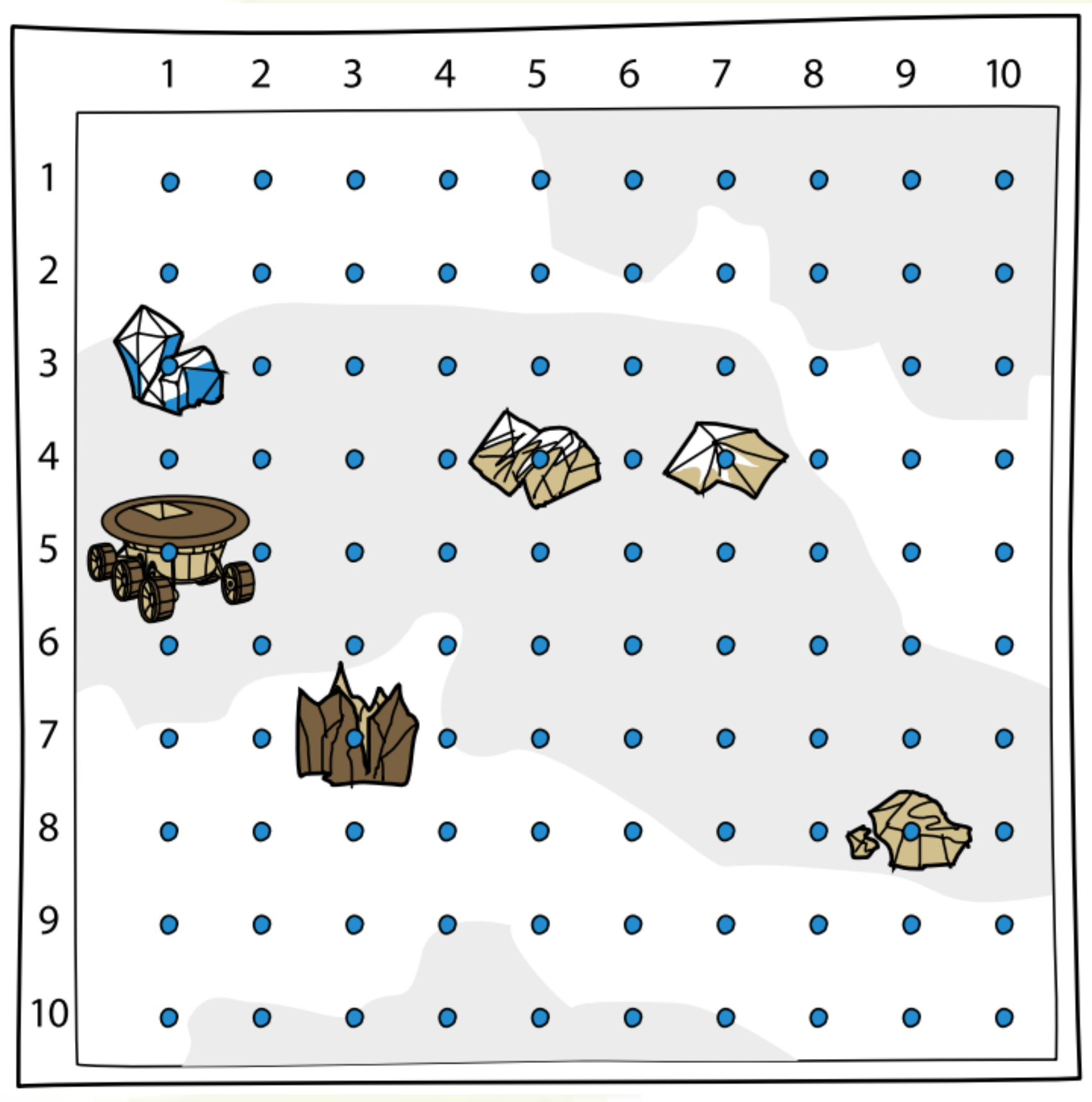
Lunatic rover road

The traveling Salesman problem

A lunar rover road was sent to the moon to collect minerals. The marked errands in the given map must be run (in no particular order). The lunar rover must start and end at the home position where it is now. Each block on the map is exactly 1 km.

Draw a graph corresponding to th problem.

Guide the lunar rover to find the optimal (shortest) route to collect all minerals.



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We would love to hear your thoughts on Key Competence Development in STEM Education!

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