TangIn

Tangible Programming & Inclusion

TangIn Toolbox

Magic Square

9 -12 years old

Calculus | Logical Reasoning

Probotic | Itineraries

www.tangin.eu

/tanginproject

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein. Project N°.: 2017-1-PT01-KA201-035975

Summary

Complete a magic square with the BOT using the chess 'knight' movement.

Expected duration: **50 min** (the lesson plan duration is flexible, and teachers can adapt them accordingly to their needs and class duration).

Learning Outcomes

At the end of the session, students are expected to:

- Understand and perform the "knight" (chess) movements in all directions;
- Complete a Magic Square;
- Program the robot adequately;
- Value STEM areas;
- Develop transversal competencies such as problem-solving, communication and reasoning;
- Develop group work skills, namely, to respect and favor the inclusion of all elements, regardless of gender, culture, etc.

Links With Curriculum Topics

Covered Curriculum Topics		
Subject		**Topics**
Engineering	**Mathematics**	Numbers and Operation • Calculus Logical Reasoning Geometry • Location and orientation – itineraries
	Technology	Programming • Concepts of programming • Programs – Results, errors, and troubleshooting Robotics • Programming objects to solve challenges

Notes for Teachers

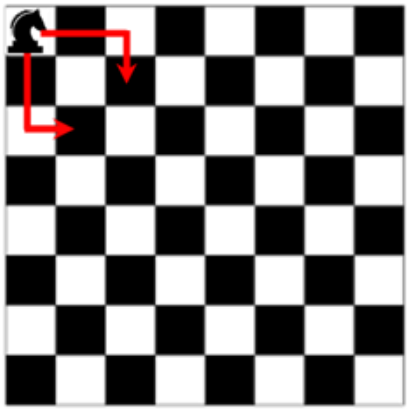
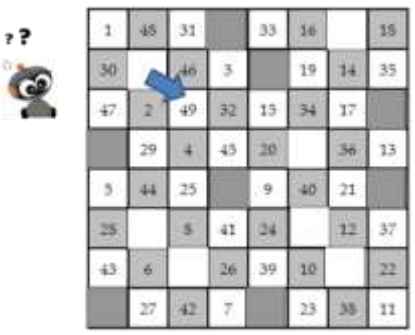
The teacher should prepare, in advance, all the materials needed and the classroom according to the activities to be developed.

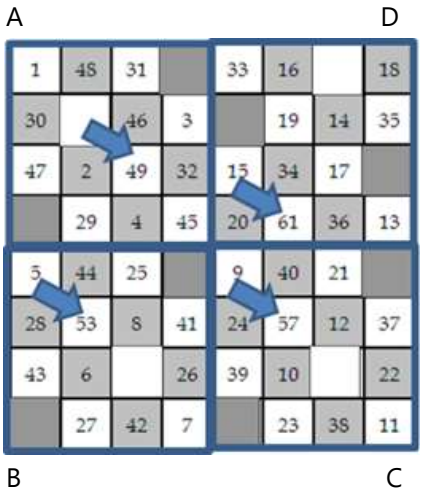
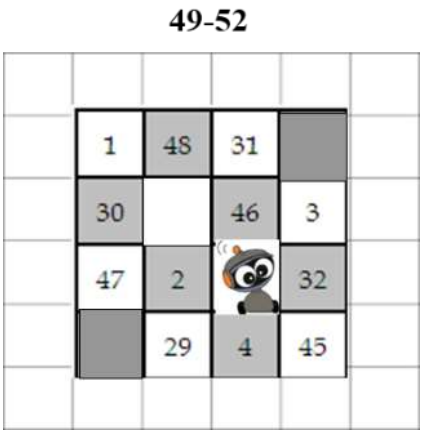
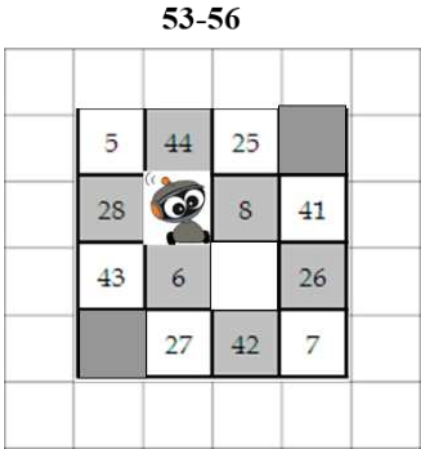
A magic square is a "*n* x *n*" square grid filled with distinct positive integers in the range (1 to n^2) such that each cell contains a different number and the sum of the integers in each row and column are equal. The sum is called the magic constant.

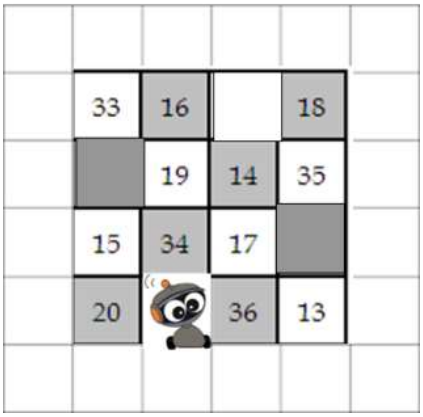
The teams should be as heterogeneous as possible to foster the integration of all students.

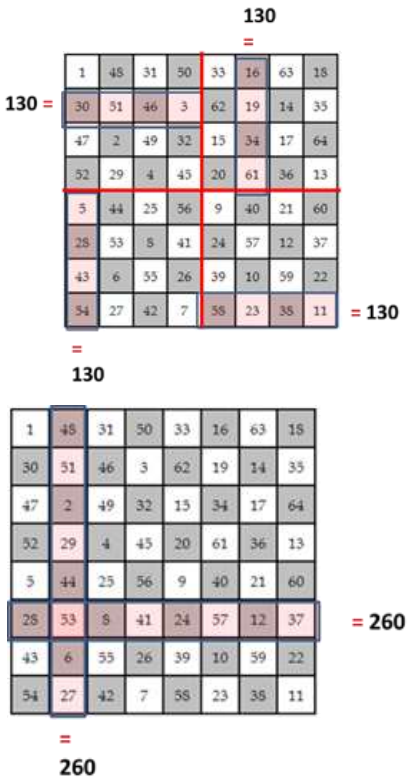
It's important that clear rules are established in terms of the order of play. This way it avoids the most active children assuming the lead and the quitter ones only observing.

Lesson Plan

Intro	15'	Class	"Today MI-GO is going to learn how to play chess. Do you know the game? Can you tell the knight movements?" Ask if anyone ever played chess or knows the rules (movements of different pieces) the size of the board (8x8) and the goal (catching the opponent king) Explain and exemplify the 'knight' movement on a chess board.	
			Release the challenge: "One great chess master made a bet in how he could go by every single square without repeating any in a chess board, using the 'knight' movement. To know where he had already been, he must number every square he lands by order. When he reached the step/square 49 he stopped and challenged MI-GO to go on and finished the board. Is it possible? Let's help him!"	

Prep	10'		To complete this very hard mission we need team-work and split the task. Let's divide the class into four groups (A-D) and each group will have the challenge to solve one quarter/quadrant (4x4) of the bigger board and starting on the arrows. Note: no need to differentiate between darker and lighter squares (just to make it look like the real chess board)	
Play	15'	Group A	Group **A** will outline a smaller **4x4** square in their (6x6) grid and fill the squares inside according to the picture. They will start with the BOT in position **49** and try to go the next empty square using the 'knight' movement and number them in sequence until **52** and all of them are filled. **Tip**: this is a magic square and so every line and column sums to the same magic number 130. So, in case of doubt, use your math skill and you know which square should be next.	
		Group B	Group **B** will outline a smaller **4x4** square in their (6x6) grid) and fill the squares inside according to the picture. They will start with the BOT in the position **53** and try to go from one empty square to another using the 'knight' movement and number them in sequence until **56** and all of them are filled. **Tip**: this is a magic square and so every line and column sums to the same magic number 130. So, in case of doubt, use your math skill and you know which square should be next.	

		Group C	Group **C** will outline a smaller **4x4** square in their (6x6) grid) and fill the squares inside according to the picture. They will start with the BOT in position **57** and try to go from one empty square to another using the knight movement and number them in sequence until **60** and all of them are filled. **Tip**: this is a magic square and so every line and column sums to the same magic number 130. So, in case of doubt use your math skill and you know which square should be next.	**57-60**
		Group D	Group **D** will outline a smaller **4x4** square in their (6x6) grid) and fill the squares inside according to the picture. They will start with the BOT in position **61** and try to go from one empty square to another using the knight movement and number them in sequence until **64** and all of them are filled. **Tip**: this is a magic square and so every line and column sums to the same magic number 130. So, in case of doubt, use your math skill and you know which square should be next.	**61-64** 

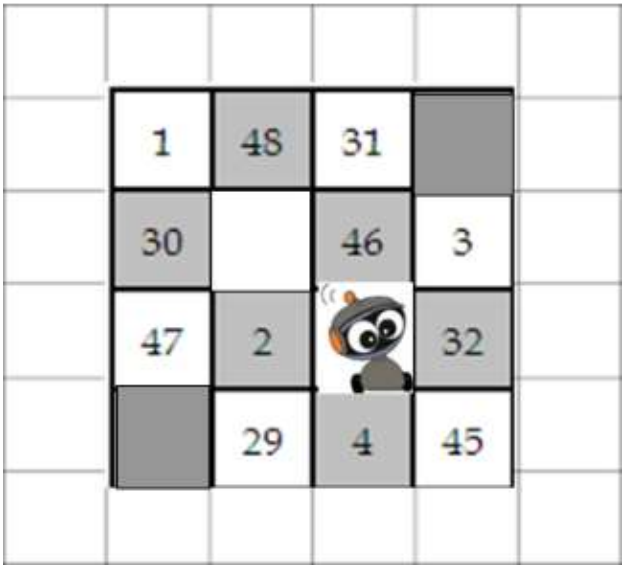
Share	20'	Class	In the end, each group will share their completed quarter so to make the final complete chess board and the class confirm that it went to all the squares without repeating. Then they must answer some challenges: • the final (8x8) square is also a magic square? • what is the magic constant? • how much should be the sum of all the columns in a quarter? • and of all square?	

Resources List & Support Material

Per each group:

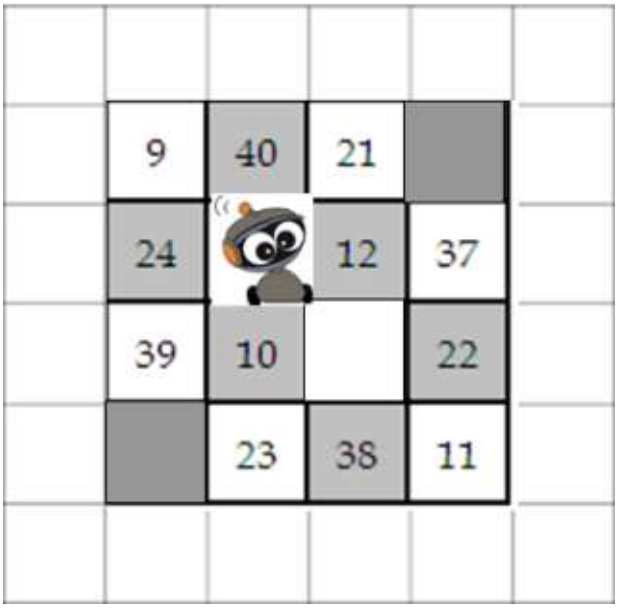
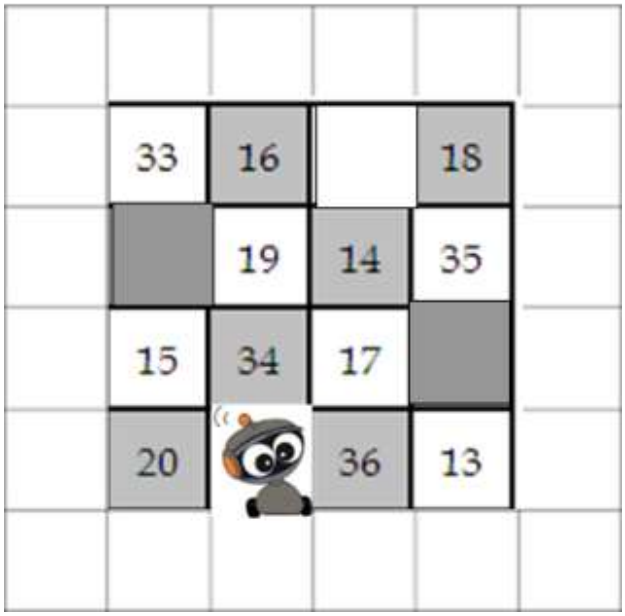
- Four robots with drawing capabilities;
- Four transparent scenarios with a 6x6 grid;
- Four black markers (easy to clean/erase);
- Alcohol for cleaning the scenarios (for teacher use only).

49-52



53-56

57-60



61-64