

[ai] explore! in Logo 1 (cycle of scenarios for early programming)

Prior knowledge

The expected prior knowledge in the field of programming and computational thinking was:

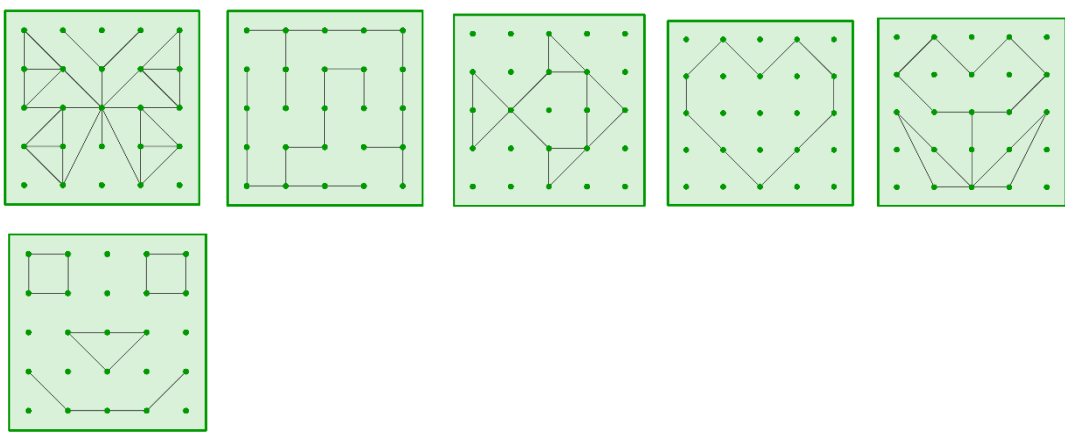
- creates a program using a visual programming interface that uses sequential programming, iterations, branching, and input values;
- solves more complex logical problems, with or without a computer.

Learning outcomes:

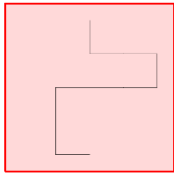
- creates an algorithm to solve a simple problem, checks the correctness of the algorithm, detects and corrects errors,
- uses a programming tool to create a program that uses input and output values and repetition.

Preparation for the activity

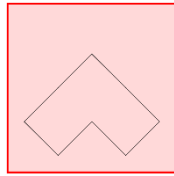
- The game [ai] explore! (Appendix 1)
- 5x5 Geoboards or paper with prepare boards (ideally one per student/computer).
In the following activity, we used the first game in the Appendix 1
- Rubber bands or pencils
- Cards with tasks for Geoboard (green cards).



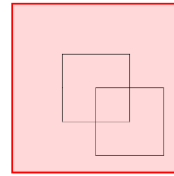
- Cards with tasks for Logo (square grid) on Geoploči (red cards).



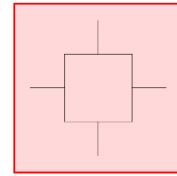
A



B

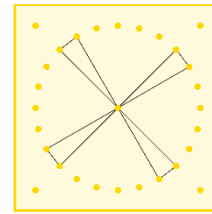
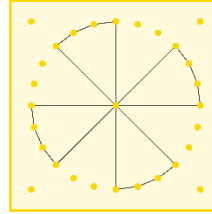
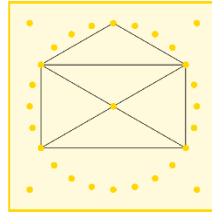
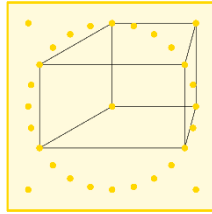
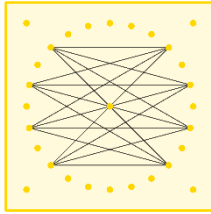


C



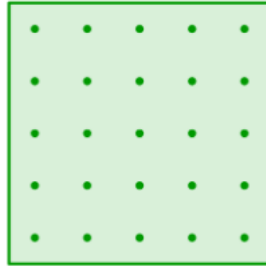
D

- Cards with tasks for round grid on Geoboard (yellow cards).



WEEK 1 (2x 45min)

1. Creating Geoboard shapes according to green cards. Additionally, students can create their own individual shapes.



Task 1: Make the shape shown in the red card on the Geoboard. Afterwards, make the program in Logo in which the Turtle will draw the same shape.

- a. Take the card A. Imagine that the Turtle needs 20 steps to walk between two pins on the Geoboard in the same row.

Solution.

```
rt 180 fd 20 lt 90 fd 40 rt 90 fd 20 rt 90 fd 60 lt 90 fd 40 lt 90 fd 20
```

- b. Take the card B. Imagine that the Turtle needs 40 steps to walk between second pin the first row and third pin in the second row on the Geoboard.

Solution.

```
cs rt 135 fd 80 rt 90 fd 40 rt 90 fd 40 lt 90 fd 40 rt 90 fd 40 rt 90 fd 80
```

- c. Take the card C. Imagine that the Turtle needs 100 steps to walk between the first and the last pin in each row on the Geoboard. Color the lines the Turtle draws in green.

Solution.

```
cs setpencolor [0 255 0] fd 50 rt 90 fd 50 rt 90 fd 50 rt 90 fd 50
```

```
pu
```

```
rt 90 fd 50 rt 90 fd 50 rt 90 fd 25
```

```
pd
```

```
rt 90 fd 25 lt 90 fd 50 lt 90 fd 50 lt 90 fd 50 lt 90 fd 25
```

- d. Take the card D. Imagine that the Turtle needs 160 steps to walk between first pin in the first row and the last pin in the second row, if it walks the shortest path between the pins. Color the lines the Turtle draws the same colors as the bands you use on your Geoboard.

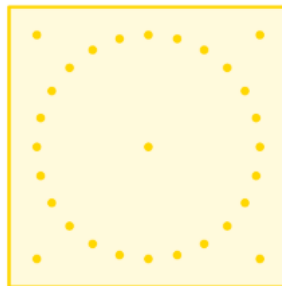
Solution.

```
cs setpencolor [0 255 0] bk 10 rt 90 fd 10 rt 90 fd 10
lt 90 fd 10 pu bk 10 rt 90 pd
fd 10 rt 90 fd 10 lt 90 fd 10 pu bk 10 rt 90 pd
fd 10 rt 90 fd 10 lt 90 fd 10 pu bk 10 rt 90 pd
fd 10 rt 90 fd 10
```

COMMANDS: fd, bk, lt, rt, pd, pu, clearscreen, pen color

WEEK 2 (2x 45min)

1. Making the shapes on the Geoboard according to yellow cards. Additionally, students can create their own individual shapes.



Task 2: Among the pins arranged in a circle on the GeoBoard, choose one pin and label it with the number 1. Label all other pins with the corresponding number, in a negative direction (clockwise).

In the following tasks, create a shape on the GeoBoard using bands. Then create a program in Logo in which the Turtle will draw that shape and let the shortest side be 50 steps long.

- a. Create a geometric shape whose vertices are in the pins closest to the pins in the corners of the Geoboard. Choose a color for each side of the shape.

Solution.

```
fd 50 rt 90 fd 50 rt 90 fd 50 rt 90 fd 50
```

- b. Create a geometric shape which has vertices in the pins 1, 8 and 16.

Solution.

```
rt 60 fd 50 rt 120 fd 50 rt 120 fd 50
```

- c. Create a geometric shape whose vertices are in the pins 3, 7, 11, 15, 19 and 23.

Solution.

fd 50 rt 60 fd 50 rt 60 fd 50 rt 60 fd 50 rt 60 fd 50 rt 60 fd 50

- d. Create a geometric figure whose first vertex is pin number 7, and between every two adjacent vertices there are two pins, using the repeat command.

Solution.

repeat 8 [fd 50 rt 45]

- e. Create a geometric shape such that every other pin is a vertex of that shape, using the repeat command.

Solution.

fd repeat 12 [fd 50 rt 30]

NAREDBE: measure of the interior angle of a polygon; repeat

WEEK 3 (2x 45min)

1. Playing the [ai] explore! game.

Task 3: How many fields does the Geoboard have? Which shape is every filled? Draw one square whose side length is 70 steps.

COMMANDS: repeat, to, end

Solution.

*to square
 repeat 4 [fd 70 rt90]
 end*

Task 4: Draw a Geoboard (5x5 square net) whose fields are squares of side length 70 steps, such that you draw 25 squares.

Solution.

*to square
 repeat 4 [fd 70 rt90]
 end*

to line

square

rt 90 fd 70 lt 90

square

rt 90 fd 70 lt 90

square

rt 90 fd 70 lt 90

square

rt 90 fd 70 lt 90

end

line

*pu lt 90 fd 5*70 rt 90 bk 70 pd*

line

*pu lt 90 fd 5*70 rt 90 bk 70 pd*

line

*pu lt 90 fd 5*70 rt 90 bk 70 pd*

line

*pu lt 90 fd 5*70 rt 90 bk 70 pd*

line

Task 5. Place the Turtle in the first square and mark the path you have on the Geoboard in front of you.

COMMAND: home

Solution.

Continue to previous task...

pu home pd

pu fd 35 rt 90 fd 35 pd

rt 90 fd 210 lt 90 fd 70 rt 90 fd 70 lt 90 fd 210

WEEK 4 (2x 45min)

1. Repetition commands and procedures

COMMANDS: repeat, to, end

Task 6. Draw the Geoboard (5x5 square net) whose fields are squares of side length 70 steps (make a procedure which draws a square and draw the Geoboard row by row or column by column, using repeat command).

Solution.

to square

repeat 4 [fd 70 rt 90]

end

to line

repeat 5 [square rt 90 fd 70 lt 90]

end

*repeat 5 [line pu lt 90 fd 5*70 rt 90 bk 70 pd]*

Task 7. Color the fields from the previous task according to the Geoboard you have in front of you. Let the background screen be some color which does not appear on the Geoboard.

COMMANDS: screencolor, fill

Solution.

to square

repeat 4 [fd 70 rt 90]

end

to line

repeat 5 [square rt 90 fd 70 lt 90]

end

to board

*repeat 5 [line pu lt 90 fd 5*70 rt 90 bk 70 pd]*

end

pu home pd

board

pu home

fd 35 rt 90 fd 35

setfc [0 255 0] fill

fd 70 setfc [255 255 0] fill

fd 70 setfc [0 255 0] fill

fd 70 setfc [0 0 255] fill

fd 70 setfc [255 255 0] fill

```

rt 90 fd 70 rt 90
setfc [0 255 0] fill
fd 70 setfc [255 255 0] fill
fd 70 setfc [0 0 255] fill
fd 70 setfc [0 255 0] fill
fd 70 setfc [255 255 0] fill
lt 90 fd 70 lt 90
setfc [0 0 255] fill
fd 70 setfc [255 0 255] fill
fd 70 setfc [255 255 0] fill
fd 70 setfc [255 0 255] fill
fd 70 setfc [0 0 255] fill
rt 90 fd 70 rt 90
setfc [255 255 0] fill
fd 70 setfc [255 0 0] fill
fd 70 setfc [255 0 255] fill
fd 70 setfc [255 0 0] fill
fd 70 setfc [255 0 0] fill
lt 90 fd 70 lt 90
setfc [0 255 0] fill
fd 70 setfc [255 0 0] fill
fd 70 setfc [0 255 0] fill
fd 70 setfc [0 0 255] fill
fd 70 setfc [255 0 0] fill

```

WEEK 5 (2x 45min)

1. variables

Task 8. Change the Task 7 in such a way that user enters the side length of a square.

Solution.

```

to square :d
  repeat 4 [fd :d rt 90]
end

to line
  repeat 5 [square :d rt 90 fd :d lt 90]
end

```

```

to board
  repeat 5 [line pu lt 90 fd 5*:d rt 90 bk :d pd]
end
pu home pd
make "d readword
board
pu home
fd :d/2 rt 90 fd :d/2
setfc [0 255 0] fill
fd :d setfc [255 255 0] fill
fd :d setfc [0 255 0] fill
fd :d setfc [0 0 255] fill
fd :d setfc [255 255 0] fill
rt 90 fd :d rt 90
setfc [0 255 0] fill
fd :d setfc [255 255 0] fill
fd :d setfc [0 0 255] fill
fd :d setfc [0 255 0] fill
fd :d setfc [255 255 0] fill
lt 90 fd :d lt 90
setfc [0 0 255] fill
fd :d setfc [255 0 255] fill
fd :d setfc [255 255 0] fill
fd :d setfc [255 0 255] fill
fd :d setfc [0 0 255] fill
rt 90 fd :d rt 90
setfc [255 255 0] fill
fd :d setfc [255 0 0] fill
fd :d setfc [255 0 255] fill
fd :d setfc [255 0 0] fill
fd :d setfc [255 0 0] fill
lt 90 fd :d lt 90
setfc [0 255 0] fill
fd :d setfc [255 0 0] fill
fd :d setfc [0 255 0] fill
fd :d setfc [0 0 255] fill
fd :d setfc [255 0 0] fill

```

Task 9. Walk the Turtle so that it follows the same path marked on your Geoboard, but this time let Turtle calculate the points.

COMMANDS: variables

Solution.

Continue to previous task...

```
pu home pd
make "points 0
pu fd :d/2 rt 90 fd :d/2 pd
rt 90
make "points 3
fd :d make "points :points+4
fd :d make "points :points+2
fd :d lt 90 make "points :points+5
fd :d rt 90 make "points :points+5
fd :d make "points :points+5
lt 90 fd :d make "points :points+3
fd :d make "points :points+2
fd :d make "points :points+5
print :points
```

WEEK 6 (2x45min)

Task 10. Set the Turtle in the middle field of the Geoboard (drawn in the Task 8). Let the Turtle make square spiral path through all the Geoboard fields.

COMMANDS: recount

Solution.

```
to square :d
  repeat 4 [fd :d rt 90]
end

to line
  repeat 5 [square :d rt 90 fd :d lt 90]
end

to board
  repeat 5 [line pu lt 90 fd 5*:d rt 90 bk :d pd]
end
pu home pd
make "d readword
```

```

board
pu home
fd :d/2 rt 90 fd :d/2
setfc [0 255 0] fill
fd :d setfc [255 255 0] fill
fd :d setfc [0 255 0] fill
fd :d setfc [0 0 255] fill
fd :d setfc [255 255 0] fill
rt 90 fd :d rt 90
setfc [0 255 0] fill
fd :d setfc [255 255 0] fill
fd :d setfc [0 0 255] fill
fd :d setfc [0 255 0] fill
fd :d setfc [255 255 0] fill
lt 90 fd :d lt 90
setfc [0 0 255] fill
fd :d setfc [255 0 255] fill
fd :d setfc [255 255 0] fill
fd :d setfc [255 0 255] fill
fd :d setfc [0 0 255] fill
rt 90 fd :d rt 90
setfc [255 255 0] fill
fd :d setfc [255 0 0] fill
fd :d setfc [255 0 255] fill
fd :d setfc [255 0 0] fill
fd :d setfc [255 0 0] fill
lt 90 fd :d lt 90
setfc [0 255 0] fill
fd :d setfc [255 0 0] fill
fd :d setfc [0 255 0] fill
fd :d setfc [0 0 255] fill
fd :d setfc [255 0 0] fill

pu home
rt 90 fd :d*2 fd :d/2
rt 90 fd :d fd :d/2 pd
repeat 4 [fd repcount*:d lt 90 fd repcount*:d lt 90]
fd :d*4

```

Task 11. Change the Task 10 such that you draw concentric circles whose radiuses are equal to the square side length.

COMMANDS: circle

Solution.

```

to square :d
  repeat 4 [fd :d rt 90]
end

to line
  repeat 5 [square :d rt 90 fd :d lt 90]
end

to board
  repeat 5 [line pu lt 90 fd 5*:d rt 90 bk :d pd]
end

pu home pd
make "d readword
board
pu home
fd :d/2 rt 90 fd :d/2
setfc [0 255 0] fill
fd :d setfc [255 255 0] fill
fd :d setfc [0 255 0] fill
fd :d setfc [0 0 255] fill
fd :d setfc [255 255 0] fill
rt 90 fd :d rt 90
setfc [0 255 0] fill
fd :d setfc [255 255 0] fill
fd :d setfc [0 0 255] fill
fd :d setfc [0 255 0] fill
fd :d setfc [255 255 0] fill
lt 90 fd :d lt 90
setfc [0 0 255] fill
fd :d setfc [255 0 255] fill
fd :d setfc [255 255 0] fill
fd :d setfc [255 0 255] fill
fd :d setfc [0 0 255] fill
rt 90 fd :d rt 90
setfc [255 255 0] fill
fd :d setfc [255 0 0] fill
fd :d setfc [255 0 255] fill
fd :d setfc [255 0 0] fill
fd :d setfc [255 0 0] fill

```

```

lt 90 fd :d lt 90
setfc [0 255 0] fill
fd :d setfc [255 0 0] fill
fd :d setfc [0 255 0] fill
fd :d setfc [0 0 255] fill
fd :d setfc [255 0 0] fill

pu home
rt 90 fd :d*2 fd :d/2
rt 90 fd :d fd :d/2 pd
repeat 4 [circle :d/2*repcount]

```

Task 12. Change the Task 8 in a way that the fields are not squares but rectangles. Let user enter the side lengths.

COMMANDS: multiple variables

Solution.

```

to rectangle :b :a
  repeat 2 [fd :b rt 90 fd :a rt 90]
end

to line
  repeat 5 [rectangle :b :a rt 90 fd :a lt 90]
end

to board
  repeat 5 [line pu lt 90 fd 5*:a rt 90 bk :b pd]
end

pu home pd
make "a readword
make "b readword
board

pu home
fd :b/2 rt 90 fd :a/2
setfc [0 255 0] fill
fd :a setfc [255 255 0] fill
fd :a setfc [0 255 0] fill
fd :a setfc [0 0 255] fill
fd :a setfc [255 255 0] fill

```

```

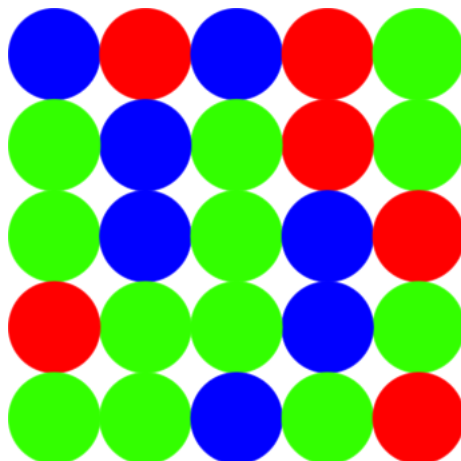
rt 90 fd :b rt 90
setfc [0 255 0] fill
fd :a setfc [255 255 0] fill
fd :a setfc [0 0 255] fill
fd :a setfc [0 255 0] fill
fd :a setfc [255 255 0] fill
lt 90 fd :b lt 90
setfc [0 0 255] fill
fd :a setfc [255 0 255] fill
fd :a setfc [255 255 0] fill
fd :a setfc [255 0 255] fill
fd :a setfc [0 0 255] fill
rt 90 fd :b rt 90
setfc [255 255 0] fill
fd :a setfc [255 0 0] fill
fd :a setfc [255 0 255] fill
fd :a setfc [255 0 0] fill
fd :a setfc [255 0 0] fill
lt 90 fd :b lt 90
setfc [0 255 0] fill
fd :a setfc [255 0 0] fill
fd :a setfc [0 255 0] fill
fd :a setfc [0 0 255] fill
fd :a setfc [255 0 0] fill

```

WEEK 7 (2x45min)

PROJECT TASK:

Make a new game using Turtle. Let the board look like shown in the following image.



Find the shortest path on the Geoboard and mark it with the bands. Make the Turtle walk through the same path and let the Turtle calculate its points (blue – 2 points, green – 4 points, red – 6 points).