photon

FUNCTIONS

www.photonrobot.com

FUNCTIONS 3.1.1

Introduction

author: Sebastian Pontus

1. Introduce the new terms to the class.

2. Discuss and define the new terms with the class

NEW TERMS

function - is a block of organized, reusable code that is used to perform a single, related action.

3. Explain to the class that they will be playing a game. It will be about recalling the pre-determined activities using one word.

4. Show the class pictures of characters from a story that you will read in a moment.

5. Assign one function to each of the heroes of the story:

King - F1 Queen - F2 Coachman - F3

In addition, if students know this game well, or if it is a class of older students, or if there is a greater need for movement, you can add two additional functions:

Carriage - F4 Horse - F5

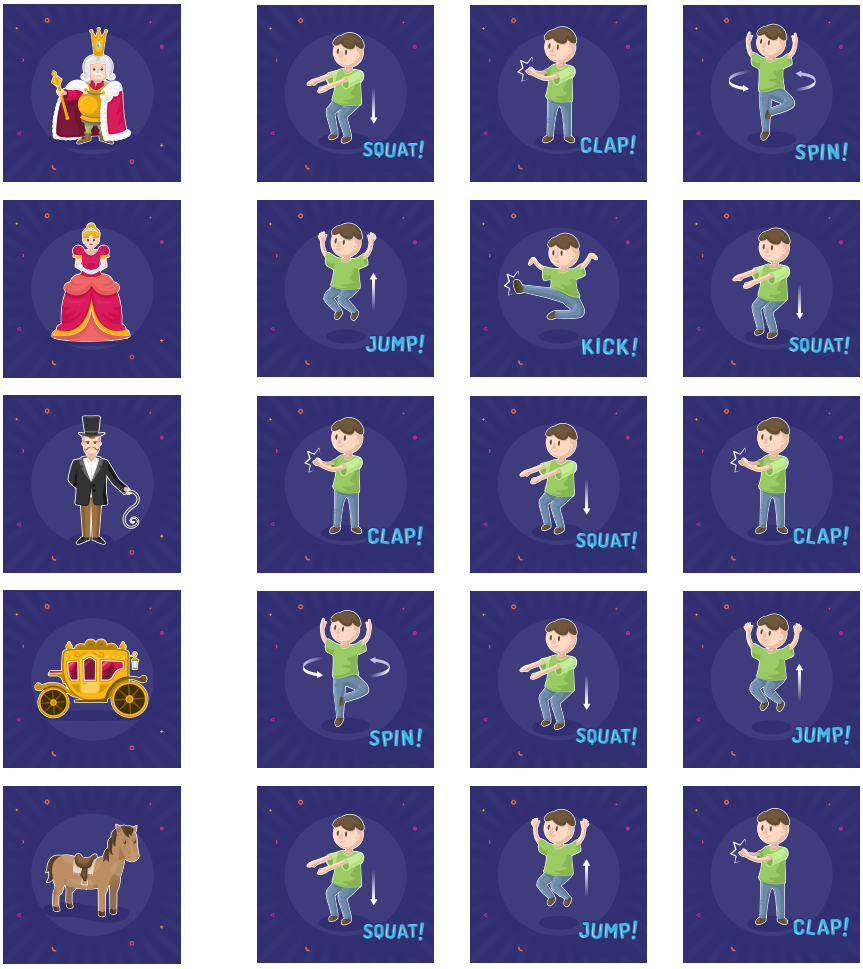
6. Now assign tasks to each function (it would be perfect when students choose tasks themselves).

Tip: In lower classes, students can choose one or two activities assigned to one function. In upper classes it would be good if every function consisted of three or four activities (and perhaps one of five?).

7. Put instructions on the board so that children can access them any time.

Sample activities: Classes 1-4

Sample activities: Classes 4-8



Example of a short story:
(You can create it yourself, shorten it, or choose a simpler one.)

Once upon a time there was a beautiful **queen** living with her husband (the **king**) on the hill. One day **the king** asked if the **queen** wanted to take a carriage ride. So, **the king** called the **coachman**. **Coachman**! Our dear **coachman**, our beloved **coachman**! Take us on a **carriage** ride. **The king** and **the queen** got into the **carriage**. **The coachman** fastened **the horse** and they were off. Along the way, **the king** was observing the beautiful landscapes. At one point **the queen** asked **the coachman** to stop **the horse**, so **the king** said: „**Coachman**! Our dear **coachman**! Our beloved **coachman**! Stop **the horse**!" So **the coachman** stopped **the horse** and **the carriage**. **The queen** got out to get some fresh air. **The king** accompanied **the queen**. **The king** admired the beauty of his castle. After returning to the castle **the King** and **the queen** got out of **the carriage**. After a while **the king** said: „ **coachman** , our dear **coachman**, our beloved **coachman**! **The queen** wants thank you for the wonderful ride in our magnificent **carriage**." When **the king** went to rest, **the coachman** closed **the carriage** and fed **the horse** after a long ride. **The king** and **the queen** lived happily ever after with their devoted **coachman**, magnificent **horse** and the elegant **carriage** admiring the beautiful corners of their kingdom.

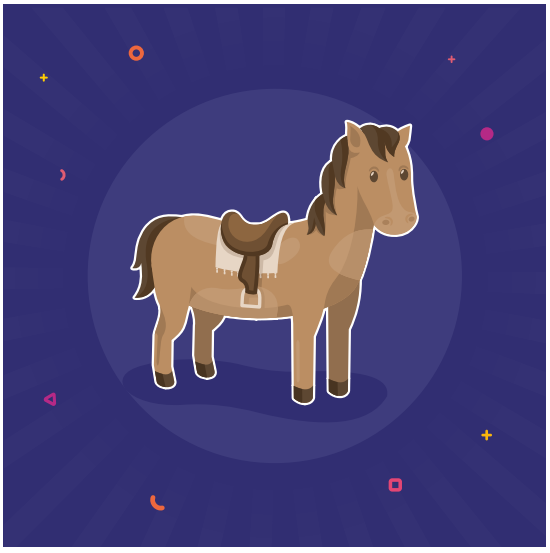
Additional tasks for the students:

1. Can you create your own story in which you will use specific functions? (Or maybe some joke?)
2. Can you tell the story again from memory?

Function cards and movement cards can be found on the next page.

Materials to be cut out: cut on the dotted line

Function cards:



Materials to be cut out: cut on the dotted line

Function cards:

FUNCTIONS 3.2.1

Offline task

Author: Sebastian Pontus

Activity 1. Memory game.

1. Ask the class if they think they have a good memory. Propose playing a memory game.

2. Explain the rules of the game to them:
The game is about searching for the same picture pairs. The cards at the start of the game are faced down. Each player may turn over only two cards during his/her turn. Players try to remember the places of individual cards. Note: Each time when a player flips over a Function card (F1, F2 or F3), she/he must perform a sequence of exercises decided before the game. The player does not perform the exercise only if she/he matches the (two cards) with the same function. She/he then takes and keeps the pair).

3. Choose an even and large enough table or floor to play.

4. Determine the number of players by dividing class into groups (minimum two players in a group) and determine the order of each player.

5. The youngest player takes the entire deck of cards and mixes it so that she/he or none of the other players can see the pictures.

6. The player places the cards on the table with the pictures down. Make sure that no players see the pictures while placing cards.

7. Set up a sequence of movements in the group when the Function is drawn, e.g.

F1 - do two squats and five jumps,

F2 - bend three times and spin twice,

F3 - clap three times and stomp twice.

8. The first player (according to the order) selects any card and puts it faced down (the card stays in place on the table). Then she/he chooses any other card and does the same. There are five possible outcomes:

(1) If both cards are the same - the player takes the pair and it's his/her turn again,

(2) If the cards are different - the player returns the cards faced down,

(3) If one of the pictures is the Function card - the player gets up and performs the movement. Then, she/he returns the card faced down,

(4) If both cards are different Function cards (e.g. F1 and F3): - the player gets up and performs the movement in order of selection. Then she/he returns the card faced down.

(5) If both cards are the same Function cards (e.g. two F1 cards) - the players takes a pair and it's his/her turn again.

9. Then the next players do the same.

Players gradually remember where the function cards and individual pairs are placed.

10. The game is over when all pairs are collected. The winner is a person who has collected the biggest number of pairs.

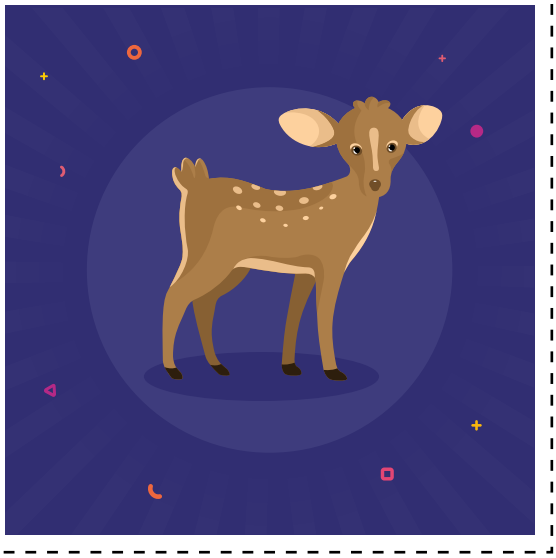
Players can also keep score for each round until reaching a certain number of points. For example, playing until someone scores 100 points. Consider setting new movement sequences for each Function before each game.

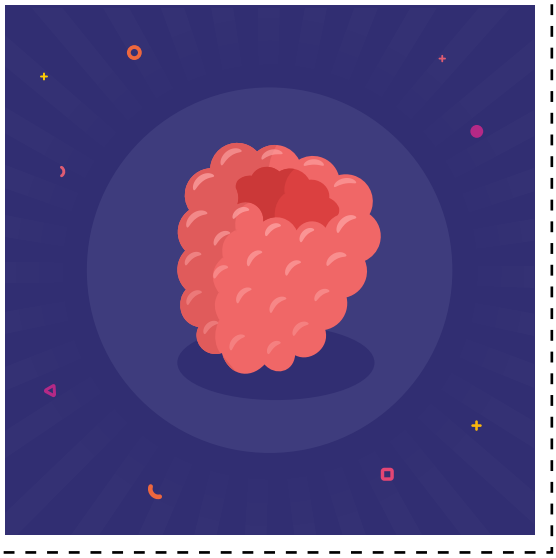
Additional information:

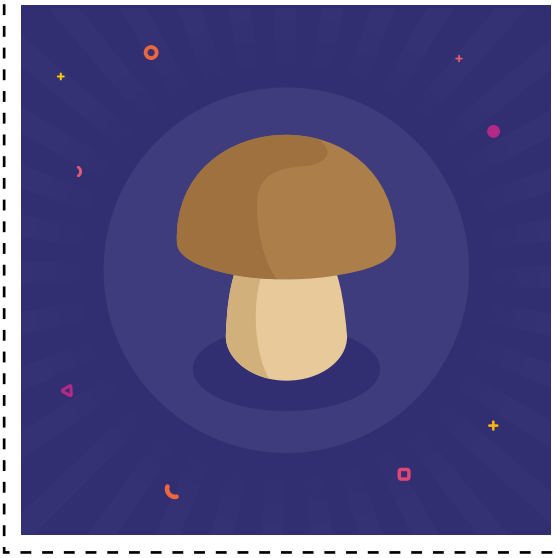
1. To add some variety to the game, add the „F4" card: The F4 card should say - mix all cards available on the table. The player who selects this card stops his/her turn and mixes all the cards on the table. The game is finished when only one card remains on the table (F4).

Materials to cut out:

cut on the dotted line







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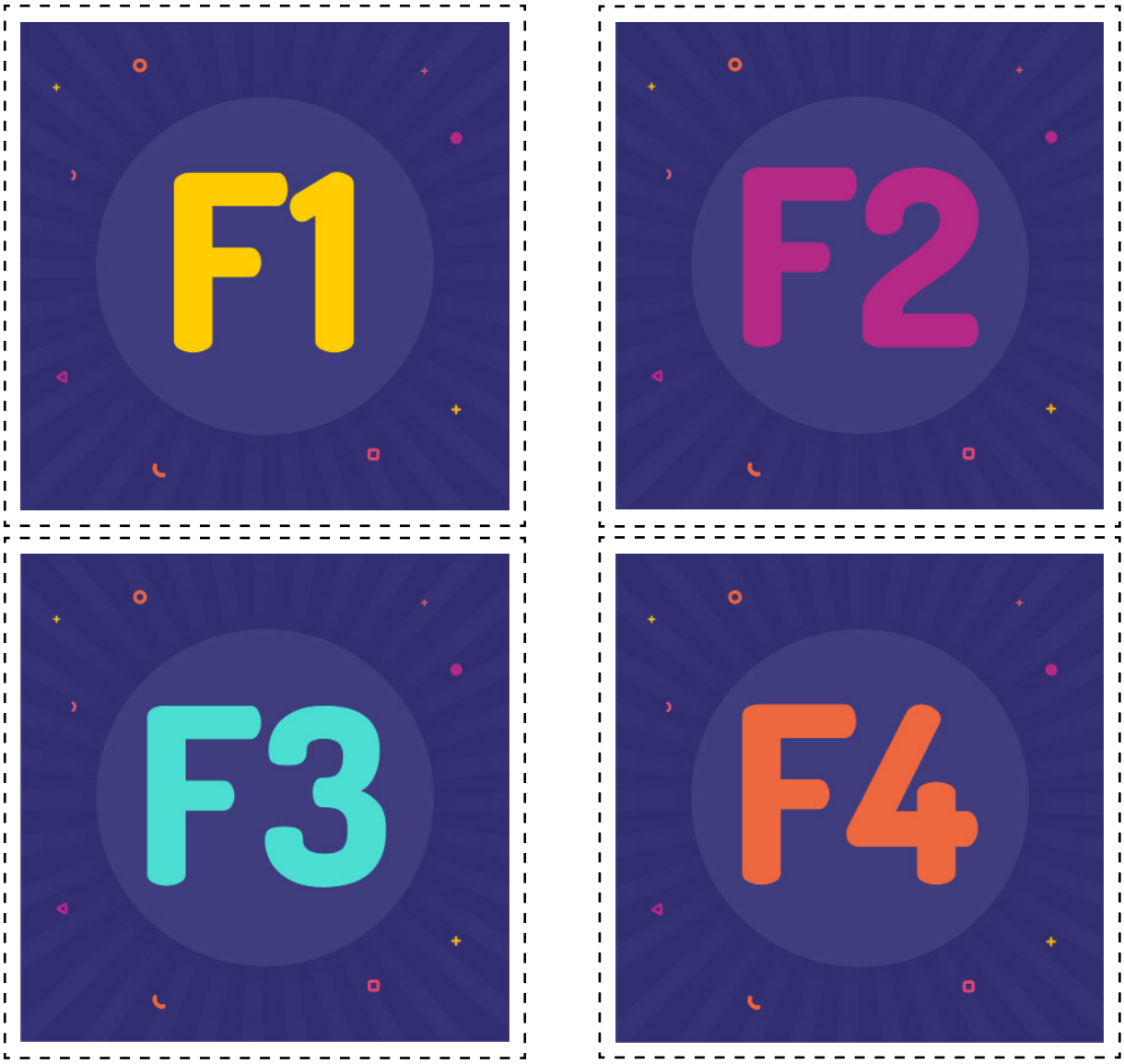


FUNCTION 3.2.2

Offline task

Author: Sebastian Pontus

Activity 1. Practical application of functions: a paper company.

1. Ask the class how one might make an envelope, a butterfly and a ship from paper.

2. Write down all activities on the board.

instructions for making an envelope: cut out the template, fold the sides of the envelope, join the sides, then, apply glue to seal the envelope.

instructions for making a butterfly: cut out the wings, cut out the torso, bend the wings.

instructions for making a ship: cut out the sails, cut out the deck, create a mast, cut out the window openings.

3. Tell the class about how the company operates:

A paper company has one specialist machine that creates:
- envelopes,
- templates of decorative butterflies and -
- models of ships for children.

The programmer has the following functions in the machine:

F1 - **Instructions for making an envelope:** cut out the template, fold the sides of the envelope, join the sides, then, apply glue to seal the envelope.

F2 - **Instructions for making a butterfly:** cut out the wings, cut out the torso, bend the wings.

F3 - **Instructions for making a ship:** cut out the sails, cut out the deck, create a mast, cut out the window openings

The programmer also included in the machine three functions of transferring cut products to boxes:

F_A - the process of transferring the item to container A (up to 1,000 products)

F_B - the process of transferring the item to container B (up to 2,000 products)

F_C - the process of transferring the item to container C (up to 4,000 products)

The machine has color sensors that distinguish 3 colors: **R** (red), **G** (green), **B** (blue). The programmer assigns product cutouts to each color (**F1**, **F2**, **F3**) and the box they should be placed (F_A , F_B , F_C).

For example,

R , **F1** , F_A - **red envelopes** in a container for **1000 products**.

4. Write down all functions on the board.

5. Pass out the worksheet to the class and instruct them to begin.

6. After completing the task, explain why understanding functions in programming is so important:

Imagine how much harder the task would be if, instead of F1, someone had to write „sequence: cut out the template, bend the sides of the envelope, join the sides, apply glue to seal the envelope". As well as F_A, F_B, F_C. How much work it would take to make even the smallest change in the algorithm? Thanks to the Function, the whole sequence is written with one simple expression F. Now you can explain why understanding functions is so important to programming.

WORKSHEET

Name: ____ Class: ____________

Activity 1. Based on the information on the board, perform the following tasks.

Task 1: Mr. X ordered 1,000 blue envelopes. Write the function the machine will read based on the information on the board:

- -

Task 2: Company Z ordered 4,000 red butterflies. Write the function the machine will read based on the information on the board:

- -

Task 3: Mrs. Y ordered 3,000 green ships. Write the function the machine will read based on the information on the board:

- -

Task 4: How many different combinations (possibilities) can the machine perform using the functions written on the board? Write down every option.

FUNCTION 3.2.3

Offline task

Author: Sebastian Pontus

Activity 1. Expedition with functions.

1. Pass out the worksheets to the class

2. The goal of the activity is for the students to follow the program written as a function than mark where Photon ends up.

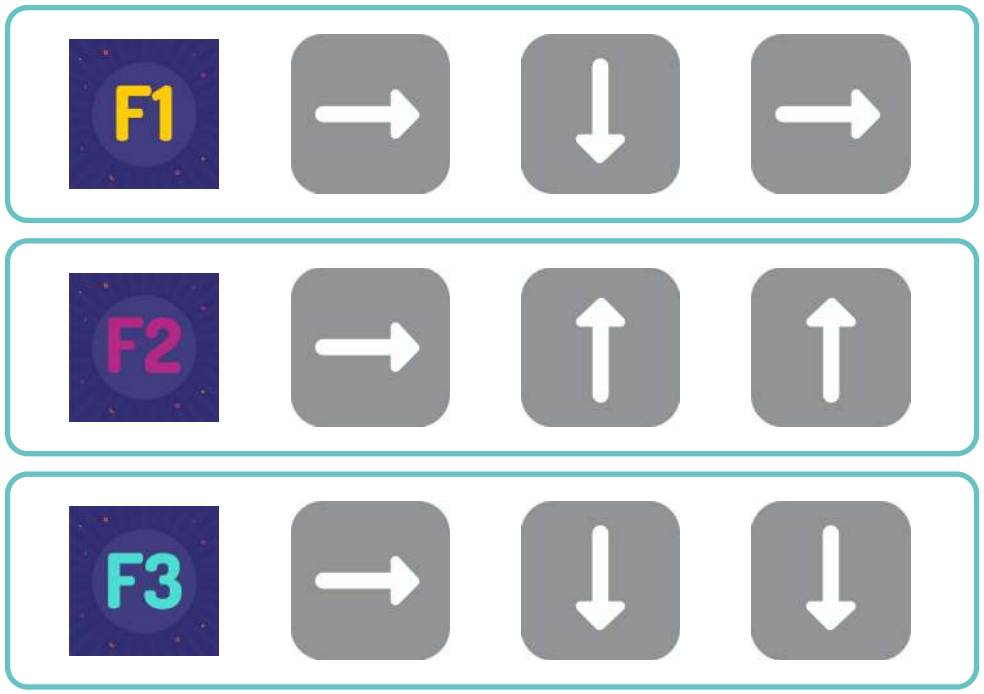
3. Ask children to prepare the pencils and perform the tasks.

4. After finishing the task, children check the correctness of the performed task for each other.

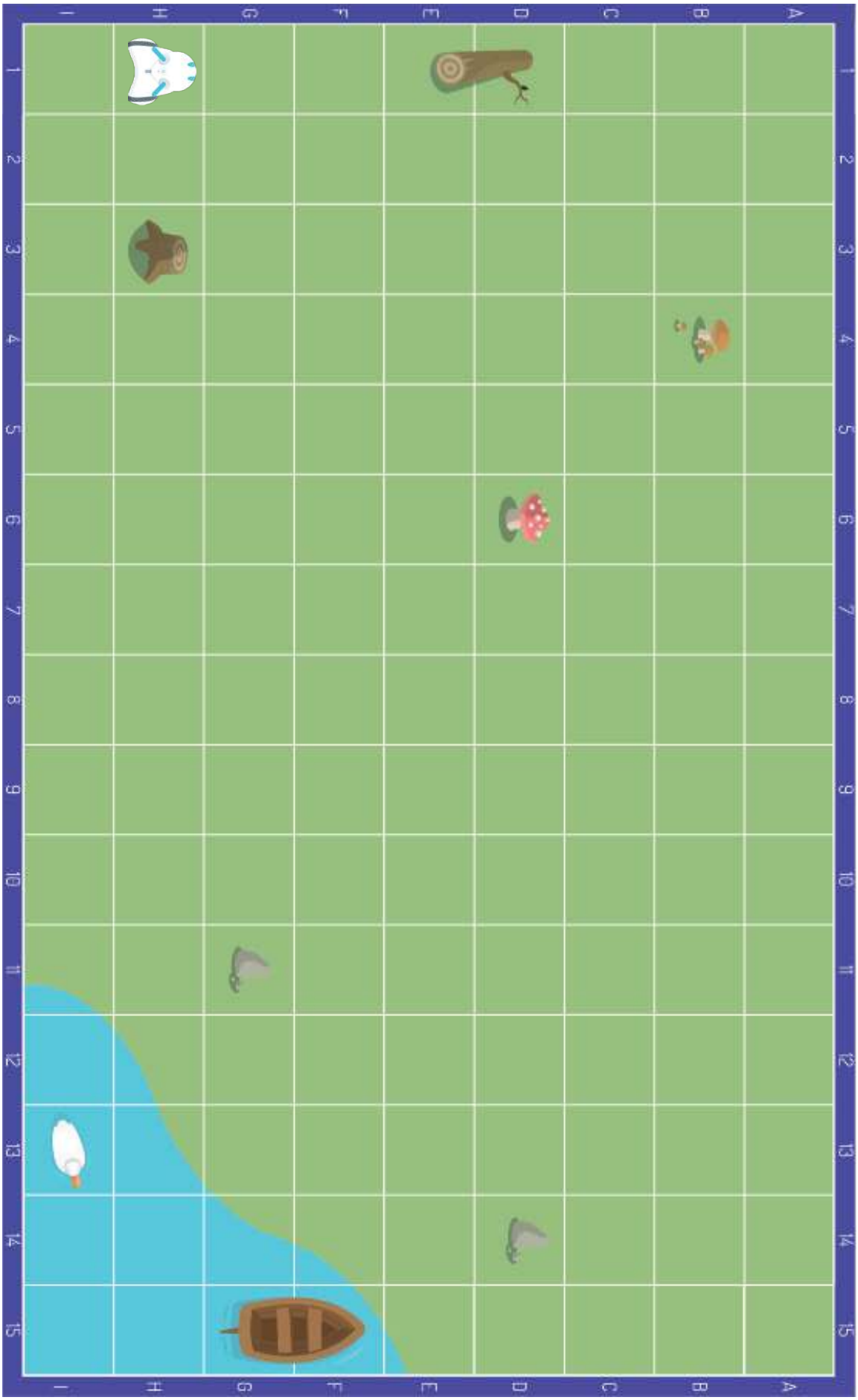
WORKSHEET

Name: _____ Class: _____

Activity 1. Below, the functions are defined and there is a program written using the function. Draw the robot's path on the provided board. There is a treasure in the field where the robot will end the program.



Program:



FUNCTIONS 3.3.1BA

Introduction to Programming: **Photon Badge**

Access code:

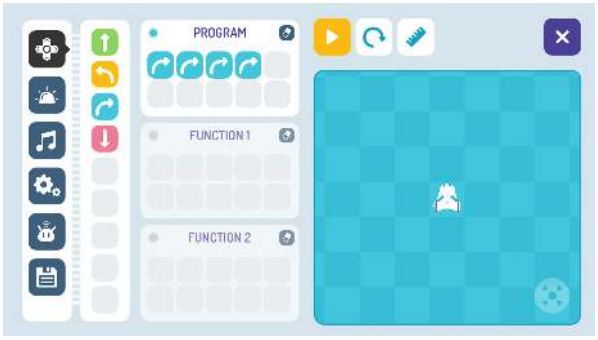
Author: Zuzanna Olechno

1. Turn on the robot and launch the Photon Edu app. If possible, project the tablet onto the board so that all children can see the tablet screen.

2. When connected to the robot, run the Photon Badge interface using the **access code**.

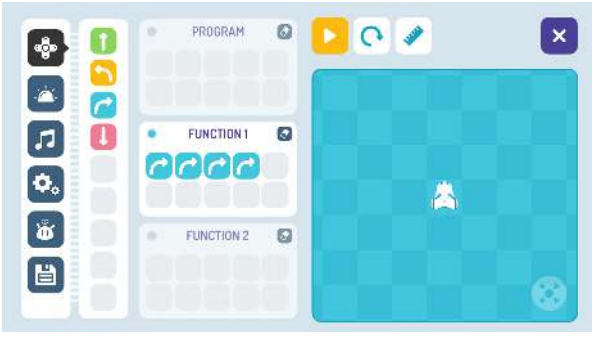
3. Show the class the function cards. Explain wht they are and how to use them.

Ask the class to write a program that will tell Photon to do one full rotation. How many rotations can the robot do in one program?



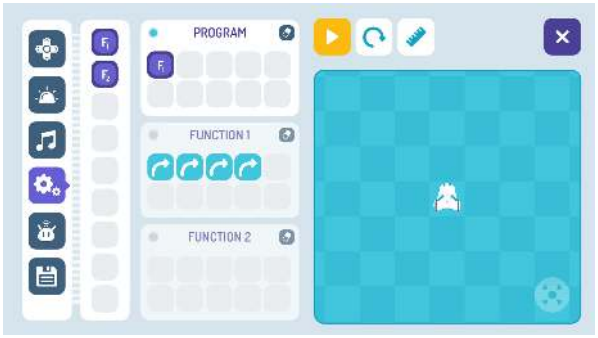
The code should include four **right arrows** from the **Movements** category to tell Photon to do 1 complete rotation Photon will only complete 2 full rotations since there are only 10 spots on the program card. What if we could replace the four rotation arrows with one rotation command? Let's see how functions can helps.

Select **FUNCTION 1** and a blue dot should appear in the left top corner. Move the arrows from the program card down to the function card.



Click the program field to activate it again (the active field is marked by a blue dot in the upper left corner).

In the category field, select the gears icon, which stands for function. Then, move the F1 icon (Function 1) to the active program field.



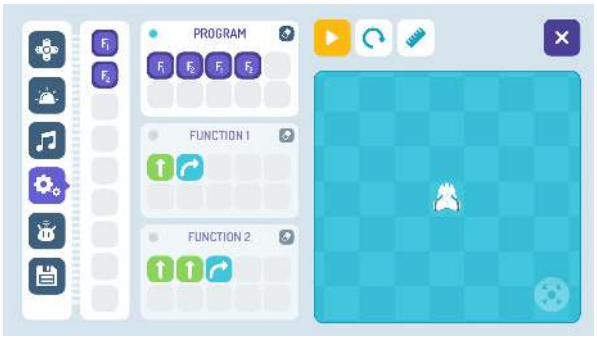
Press the play button to start the program. How many rotations can the robot make during the duration of one program? What if we wanted the robot to spin once in both directions? (we can create a function for rotation to the left and modify the program)...

4. Pass out the worksheet and movement icons. Instruct students to cut them out. Each student should get: 4 forward arrows, 2 right arrows, 2 F1 and 2 F2.

5. Once the task is completed, check the work as a class.

6. At the end, program the robot together, so that it will make chosen program from the worksheet.

* To change the length that Photon travels, select the icon with a ruler. Then, select one of the icons with the scale pre-defined, or set it with the slider.

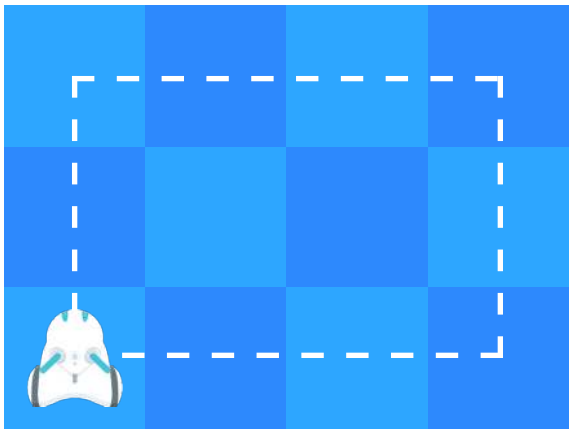


WORKSHEET

Name: _____ Class: _____

Activity 1. Write a program using the F1 and F2 functions that will tell Photon to travel in the shape of a:

Task 1: Rectangle

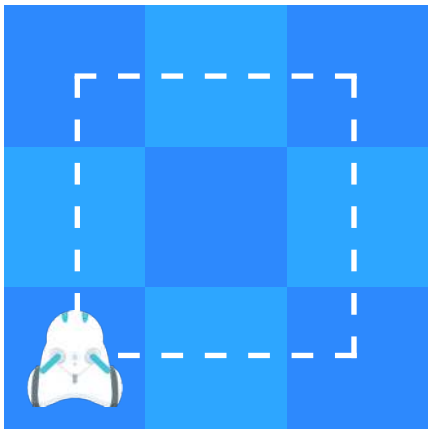


PROGRAM

FUNCTION 1

FUNCTION 2

Task 2: Square



PROGRAM

FUNCTION 1

FUNCTION 2

FUNCTION 3.3.1BL

Introduction to Programming: **Photon Blocks**

Access code:

Author: Adrian Pontus

1. Turn on Photon and launch the Photon Edu app. If possible, project the tablet screen onto the board so that the class can see the tablet screen.

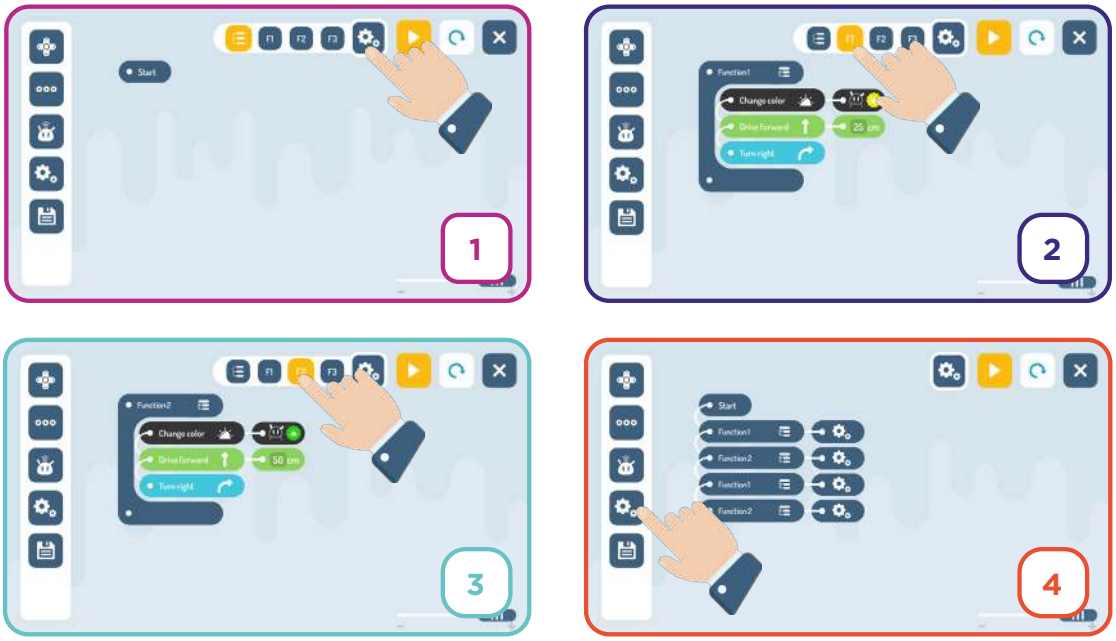
2. When connected to the robot, launch the Photon Badge interface using the **access code**.

3. Follow the steps below that explaind what functions are and how to use them.

Tell the class they will be writing a program that will move Photon around the perimeter of a 25 x 50 cm rectangle:

Program Photon to move around the perimeter of a 25 x 50 cm square using functions:

[1] Select the gears icon next to the yellow play button
[2] Select function 1 (F1) and place progra the short side of the rectangle: (a) change his color to yellow, (b) go ahead 25 cm and (c) turn right,
[3] go to function screen 2 in the function panel and design the program for the londer side: change color to green, go forward 50 cm, turn right,
[4] then return to the home screen and use the function blocks, design a program that will allow Photon to move around the perimeter of the rectangle.



4. Instruct the class to work together.

Select drive forward from the Movement category, and after clicking it the command will appear under the „start" command. Click the step length field, then set it by selecting the icon with the specified value or by moving the Photon icon along the scale:

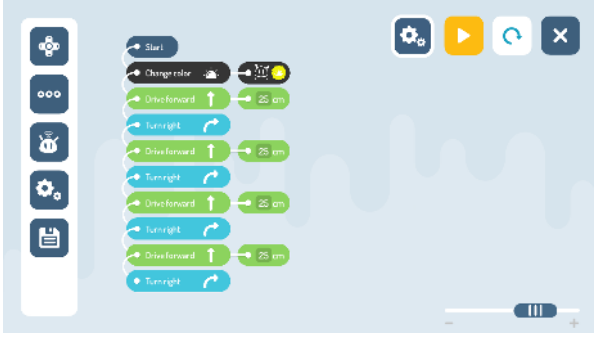
Then, together with the group, write the entire program needed to complete the task, check the code by running the program:

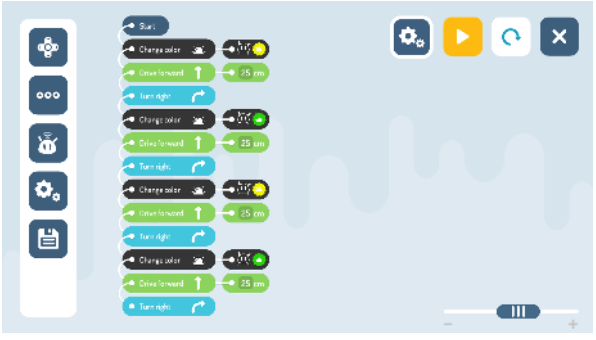
Ask the class the following question:
1. Can you see repeating code in the written program?

a. go ahead 25 cm + turn right,
b. go ahead 50 cm + turn right

2. Can you mark and separate the repeating code in some way (e.g. by using a color change ...)?

Add to the code by changing the code before each repeating code (category Actions):



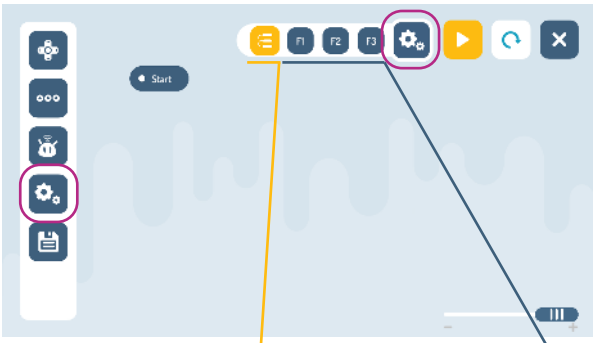


3. What code you name the separated separatory code (short and long side)?

4. Can you simplify the program in some way?

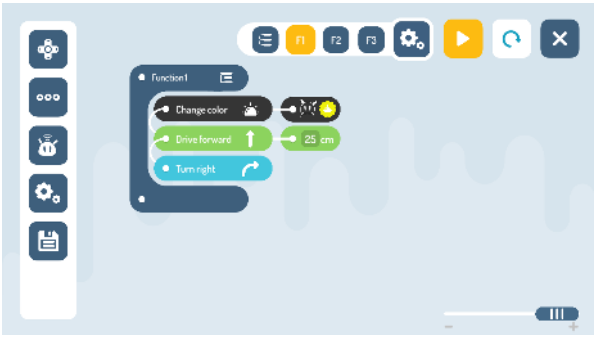
Show the group an alternative way of writing the program but using sunction:

F1 function: the short side:



Select **functions category** on the top or sidebar icons.
The top bar shows icons for switching between
the main program, and **F1, F2, F3 functions**.

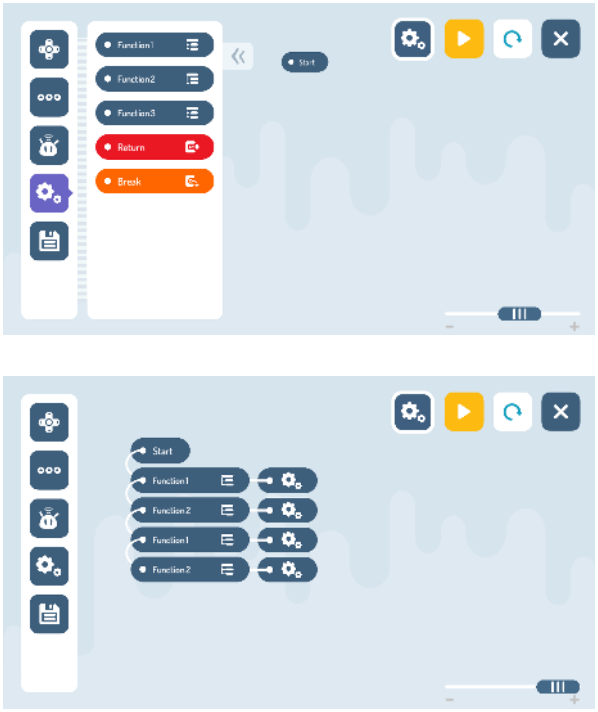
Select the F1 field, then write the part of the code for the short side of the rectangle only:



F2 function: The long side:

In the function field F2, write the code for the long side:

In the main program, design the program code using the commands **Function 1** and **Function 2** (Remember to use the functions category in the sidebar). Check the program by selecting the play button. Has the behavior of the robot changed relative to the previous program? How did the length of the code change?



5. Explain to the class that they now complete the robot dance activity idependently (work card).

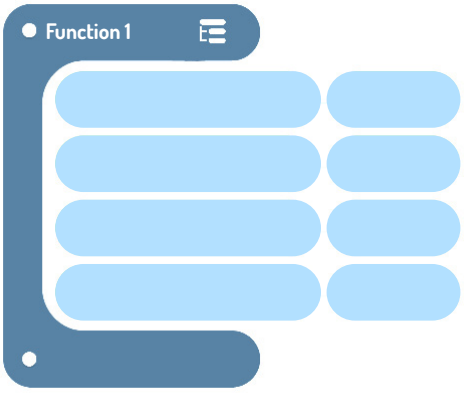
6. Review how and why to use functions. If possible, run all of the robot dance programs simultaneously to create a „Photon disco"!

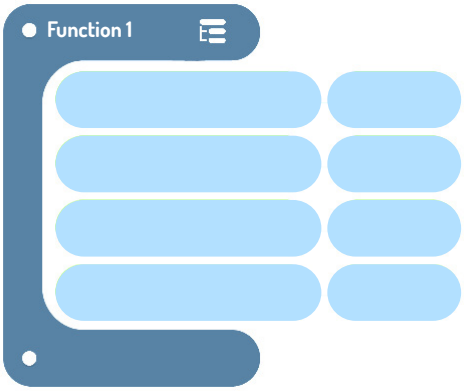
WORKSHEET

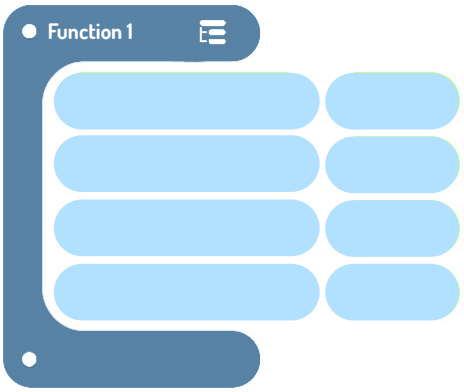
Name: _____ Class: _____

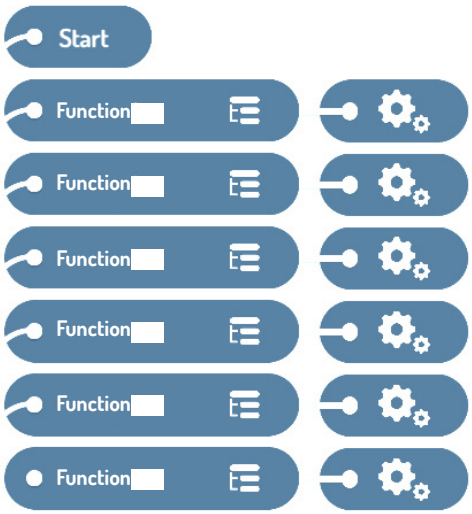
Activity 1. Using the commands Function 1, Function 2 and Function 3, create a unique dance for your robot. Each program should consist of 4 elements. You can use commands from the movement category and color change commands from the action category. With the whole group establish quantity and order of performed moves. You can use roll the dice to choose the numbers.

1 pip - Function 1
2 pips - Function 2
3 pips - Function 3
4 pips - Function 1
5 pips - Function 2
6 pips- Function 3









FUNCTIONS 3.3.1CO

Introduction to Programming: **Photon Code**

Access code:

Author: Adrian Pontus

1. Turn on the robot and launch the Photon Edu app. If possible, project the tablet screen onto the projector so that the class can see exactly what is happening on the tablet screen.

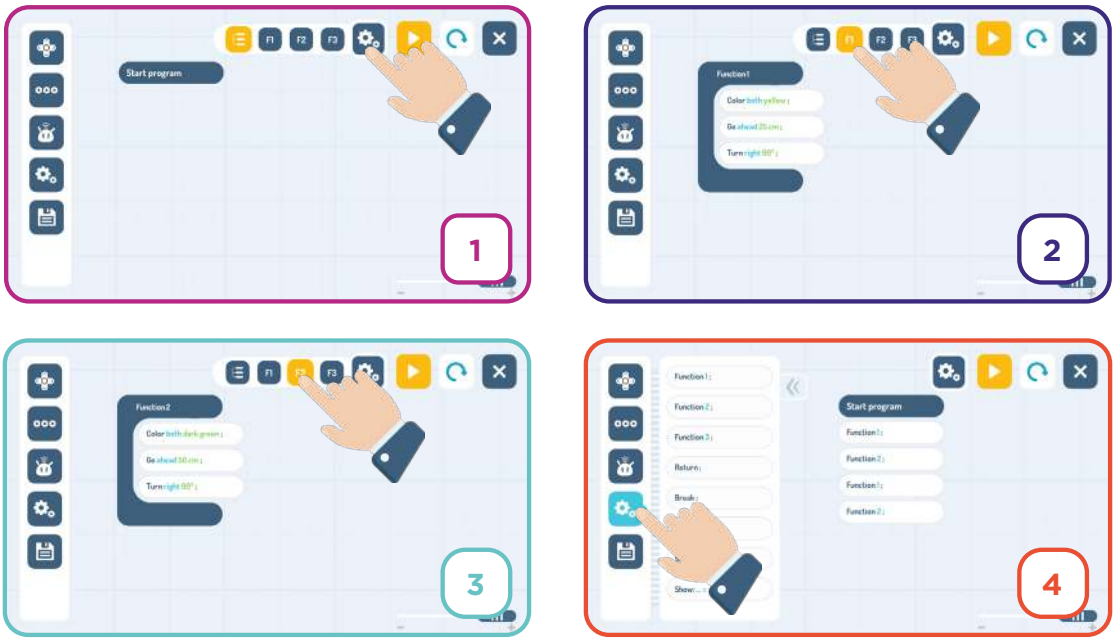
2. When connected to Photon, launch the Photon Code interface using the **access code**.

3. Explain what functions are, and how to use them to the class.

Explain to the class that they will be designing a program that will allow Photon to move around the perimeter of a 25 x 50 cm rectangle:

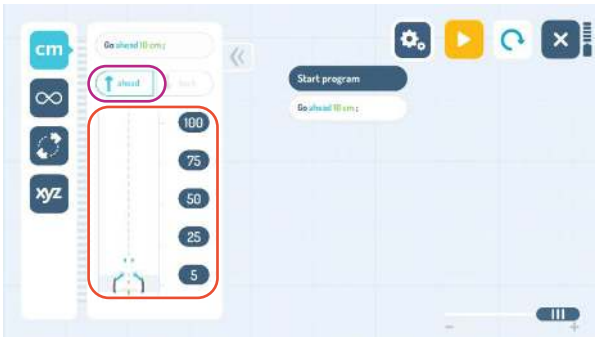
Task: Design a program that will allow Photon to move around the perimeter of a 25 x 50 cm rectangle using functions:

[1] Open the function panel next to the yellow play button,
[2] select function 1 and code the short side of the rectangle: change the color to yellow, go ahead 25 cm, turn right,
[3] go to function screen 2 in the function panel and code the loger side of the rectangle: change color to green, go forward 50 cm, turn right,
[4] then return to the home screen and use the function blocks from the sidebar, program Photon to move around the perimeter of the rectangle.

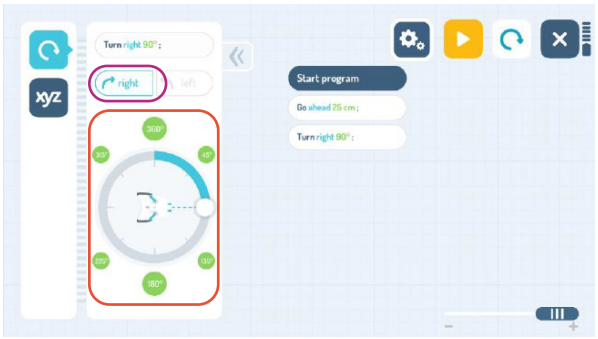


4. Tell the class to work on the task together.

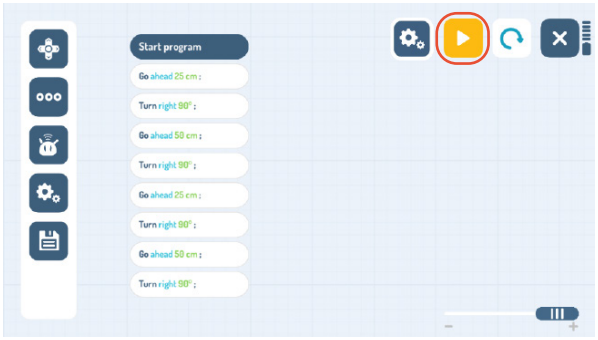
Select go ahead from the Movement category on the sidebar, and after clicking it, the command will appear under „start program". In the expanded command field, select **direction (ahead)**, then set **the step length** by selecting the icon with the specified value or by moving the Photon icon along the scale:



Next, code Photon to turn right:
After choosing the Turn command, select the appropriate **direction** and the **rotation angle.**



Then, as a class code the entire program needed to complete the task, check the code **running the program**:



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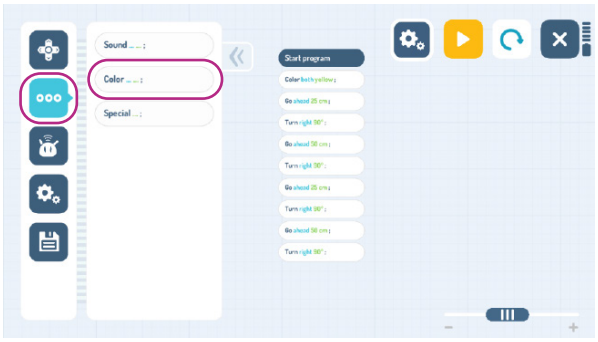
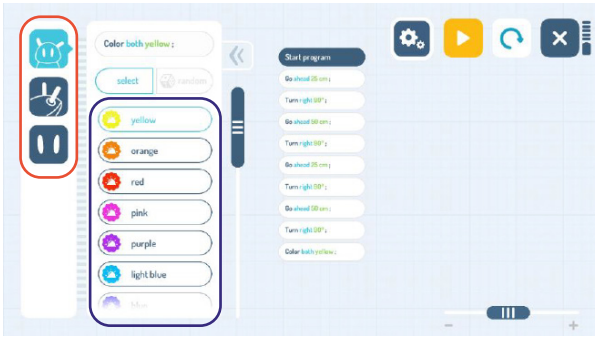
a. go ahead 25 cm + turn right,
b. go ahead 50 cm + turn right

2. Can you mark and separate the repeating code in some way (e.g. by using a color change ...)?

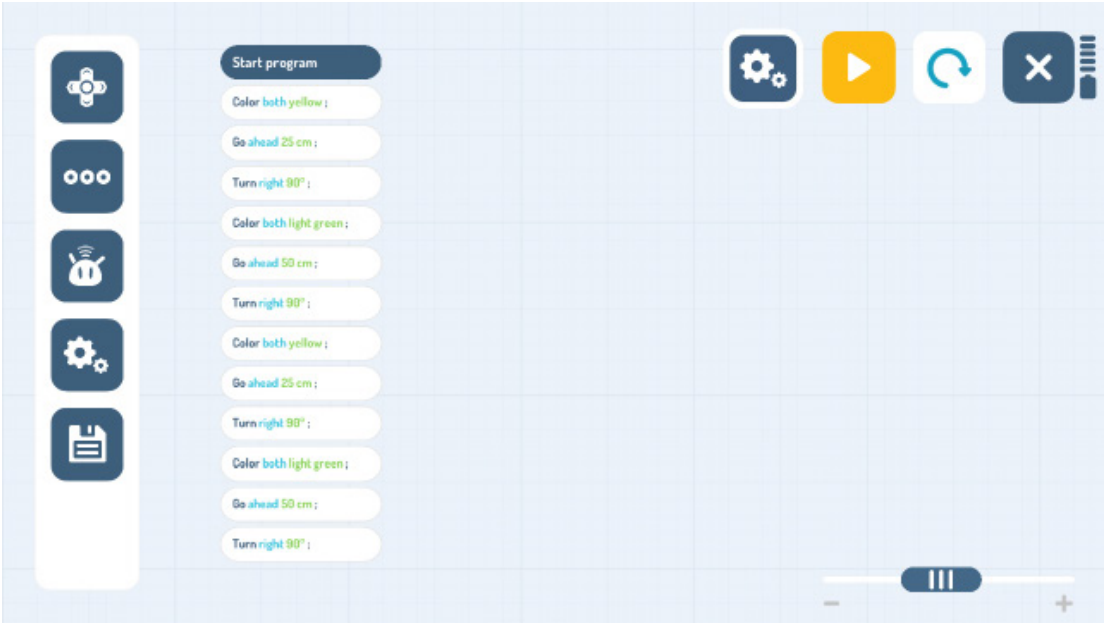
Expand the code to include a color change (**Color...; Category Actions**): Separate each side with the color command:



Next, select **the color change icon** and an **appriopriate color**.

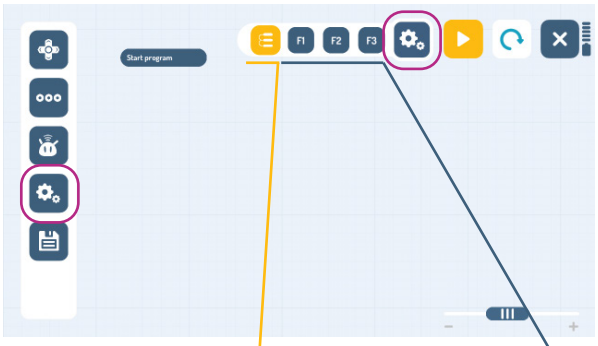


3. Are you able to name the separated repeating code (short and long side)?
Can you simplify the recorded code in some way?



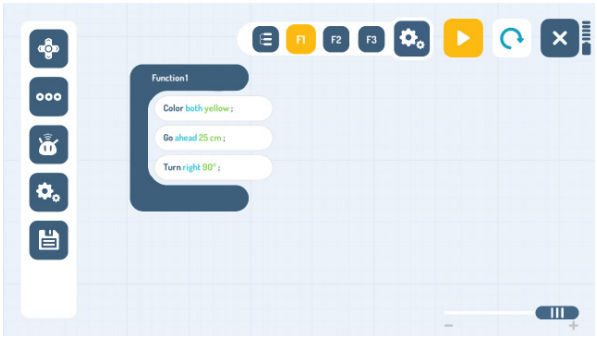
Show the class how to create two functions, as a way to simplify the code:

F1 function: The short side



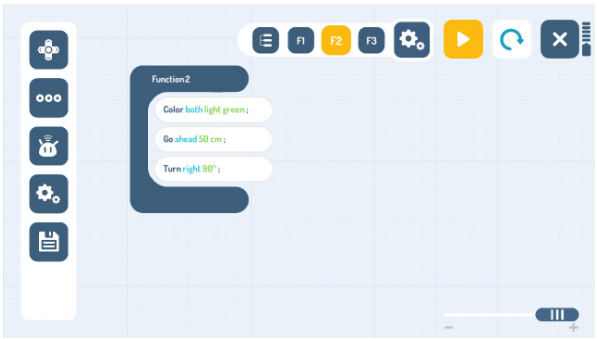
Select **category function** on the side or top bar.
The top bar will show icons for
the main program, and **F1 , F2 , F3 functions**

Select the **F1** field, then write the part of the code for the short side of the rectangle:

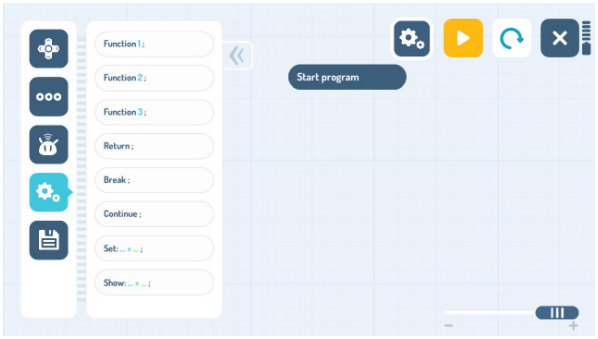


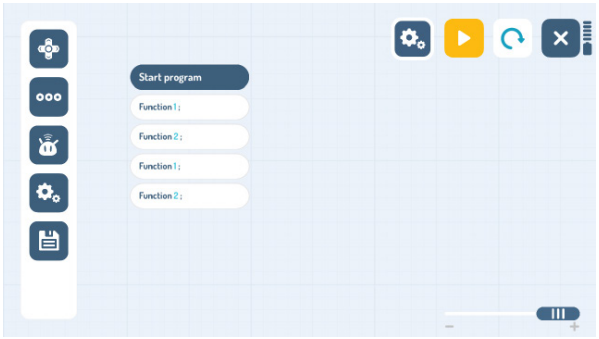
F2 function: The long side:

In the function field **F2**, write the code for the long side:



In the main program, code program using the commands **Function 1** and **Function 2** (Function category in the sidebar icons). Check the program by selecting the play button. Has the behavior of the robot changed relative to the previous program? How did the length of the code change?





5. Explain to the Class that they will cample a Photon dance activity independently.

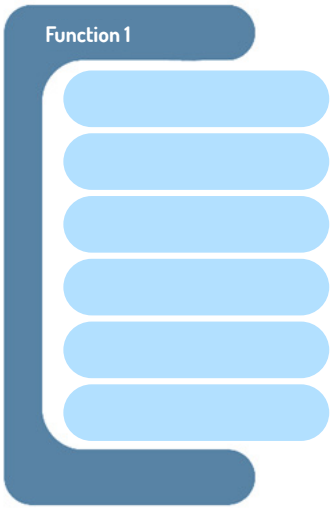
6. Review what functions are and how to use them. If possible, run the Photon dance programs simultaneously to create a „Photon disco”!

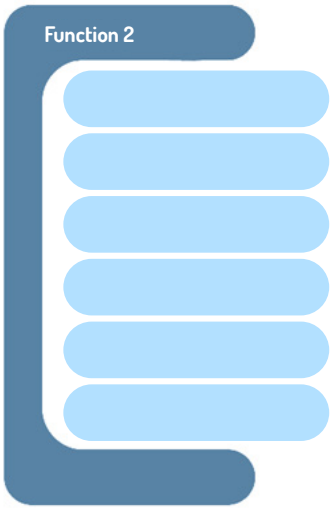
WORKSHEET

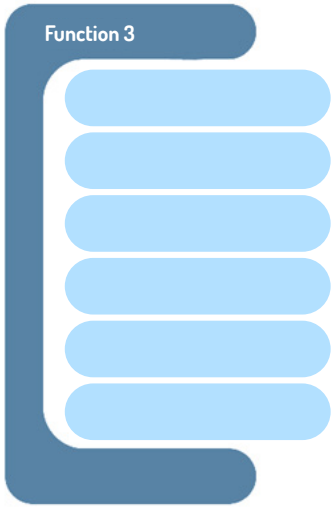
Name: _____ Class: _____

Activity 1. Using the commands Function 1, Function 2 and Function 3, create a unique dancing figures for your robot. Let each Function consist of 6 line of code.You can use commands from the movement and color categories from the sidebar. With the whole group establish quantity and order of performed moves. You can use roll the dice to choose the numbers.

1 pip – Function 1
2 pips – Function 2
3 pips – Function 3
4 pips – Function 1
5 pips – Function 2
6 pips – Function 3







FUNCTION 3.4.1BA

Activity: **Photon Badge**

Access code: 

Author: Sebastian Pontus

1. Divide the class into groups of 4. Give each group the Photon and a tablet with the Photon Edu application.

2. Pass out worksheets to the class and explain the activity.

3. Instruct the class to turn on Photon and connect him to a device. Tell students to select the Photon Edu app and input the **access code.**

4. Explain to the class that they shpuld complete the worksheet. When completed, they should raise their hand.

5. Check the program.

WORKSHEET

Name: _____ Class: _____

Activity 1. Sketch out a code that will move Photon around the perimete of:
- a rectangle measuring 30 by 50 cm,
- a square with the dimensions of 40 cm.

Note: the program should be written in the shortest possible way.

Program for the rectangle measuring 30 by 50 cm:

Program for a 40 cm square:

Activity 2. Practice moving around the parimeter in the classroom. Find object which you can drive around. It could be a chair, table, satchel, notebook or a book.

In pairs find out which one of you will drive closer to the obstacle (without touching it)

Measure the obstacle's perimeter and then the total path of the robot.

Space for notes:

FUNCTIONS 3.4.2BA

Activity: **Photon Badge**

Access code: 

Author: Sebastian Pontus

1. Split up the class into groups of 4. Give each group a Photon and a tablet with the Photon Edu app.

2. Pass out worksheets to the class and explain they will be completing the tasks.

3. Instruct the class to turn on Photon and connect him to a device. Tell students to select the Photon Edu app and input the **access code.**

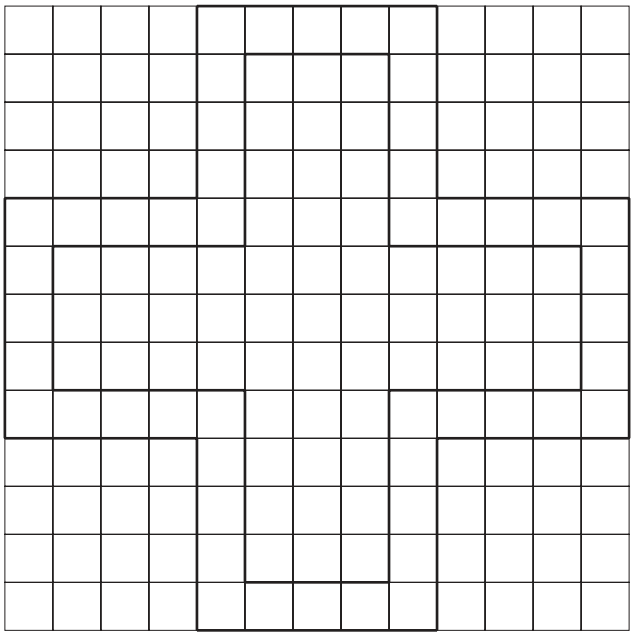
4. Explain to the class that they shpuld complete the worksheet. When completed, they should raise their hand.

5. Check the program.

WORKSHEET

Name: _____ Class: _____

Activity 1. Can you „draw” the figure below using only 2 functions?



FUNCTIONS 3.4.1BL

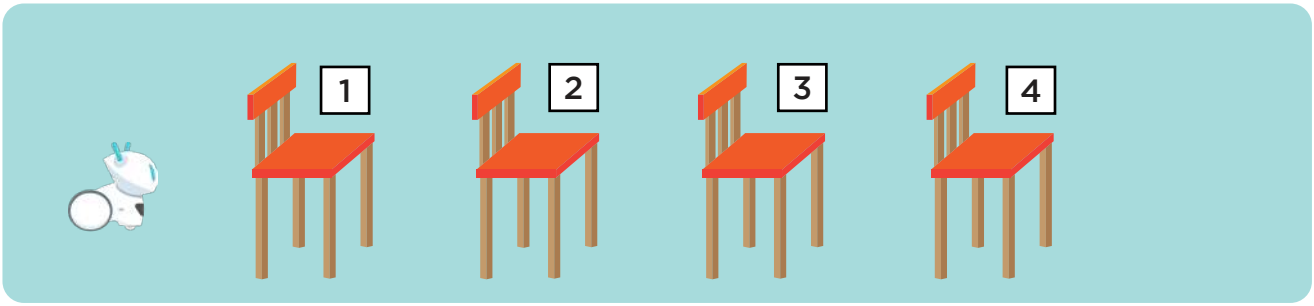
Activity: **Photon Blocks**

Access code:

Author: Sebastian Pontus

1. Split the class into groups of 4. Give each group the Photon and a tablet with the Photon Edu app.

2. Prepare the slalom activity using chairs and mark them with numbers from 1 to 4 (as below)



3. The classes task will be to code Photon so that he moves in and out of the chairs. The even numbered chairs should be on the right where as the add numbered chaird should be on the left. The team completing the task the fastest wins. Note: Students should plan and measure the route befotehand.

If using more robots create a slalom for each of them!

FUNCTIONS 3.4.2BL

Activity: **Photon Blocks**

Class code:

Author: Sebastian Pontus

1. Split the class into groups of 4. Give each group the Photon and a tablet with the Photon Edu application.

2. Match 2 groups together - they will be opponents.

3. Groups will be assigning letters and a sequence of 3 commands to a function.

Task: There are F1, F2 and F3 functions provided. Each of them is assigned the letter M, A or T. For each function, assign 3 commands, (eg. go ahead, change the color and turn right.) Then, using the functions, create a program that will recreate the following algorithms: MAMA / TATA / MATA / TAMA / TAM / MAT.

The opposing team's task is to guess the sequence of commands for each function. The winner is the team that correctly guesses the sequences after the smallest number of reconstructed algorithms.

Example:

F1 - M - go one step ahead, change color to red, turn right
F2 - A - go one step back, left turn, color change to green
F3 - T - change of color to orange, change of color to pink, go one step ahead

The encoded algorithm MAMA:

F1 , F2 , F1 , F2

FUNCTIONS 3.4.1CO

Activity: **Photon Code**

Access code: 

Author: Sebastian Pontus

1. Split the class into groups of 3. Give each group the Photon and a tablet with the Photon Edu application.

2. Pass out worksheets to the class with three tasks (one for each child).

3. The goal will be to program, using only one function, the Photon path along the perimeter of the following shapes: square, hexagon and octagon.

Note: in order to facilitate the activity, display the inner angle of each shape.

WORKSHEET

Name: _____ Class: _____

Activity 1. Code Photon to travel the perimeter of a regular polygon (all sides and angles are equal) using only one Function. Photon should return to the beginning of the route at the end of the program.

Use the following polygons:
A) square
B) hexagon
C) octagon

Note: divide up the polygons so that each person in the group codes 1 shape.

Make the calculations and plan the programs below:

FUNCTIONS 3.4.2CO

Activity: **Photon Code**

Access code: 

Author: Sebastian Pontus

1. Divide the children into groups of 3. Give each group a Photon and a tablet with the Photon Edu application.

2. Pass out the printed Morse code card o each group.

3. Then, pass out the worksheets.

4. Explain to the class that they are to encode the words on the worksheet using the Morse code signals and the functionality of Photon which is the color change of the tentacles and eyes.

Note: During the class, instead of changing the color of the tentacles, you can also use sound recording. Record a short and a long signal, then design the program using these sounds.

WORKSHEET

Name: _____ Class: _____

Activity 1. Using the Morse code and using the ability to change the color of Photon's antenneas, encode the words below. Do not forget to use the function.

MAMA

SOS

TATA

LALA

FUNCTIONS 3.5.1

Summary of the concepts

Summary of the concepts:

1. Ask children to give examples of how to use functions in everyday life. How can it help us?

2. Give the class a moment to explain and the test out their ability to use functions.