algoritmics

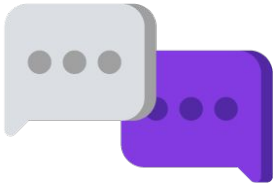
Module 2. Lesson 5.

Nested control constructs

Link to the methodological guidelines

Discussion:

Helper bot Julia



Great job!

The “Friend Around” social network greatly appreciated the work of ProTeam specialists and decided to add a helper bot named Julia to the network.

Julia must be able to:

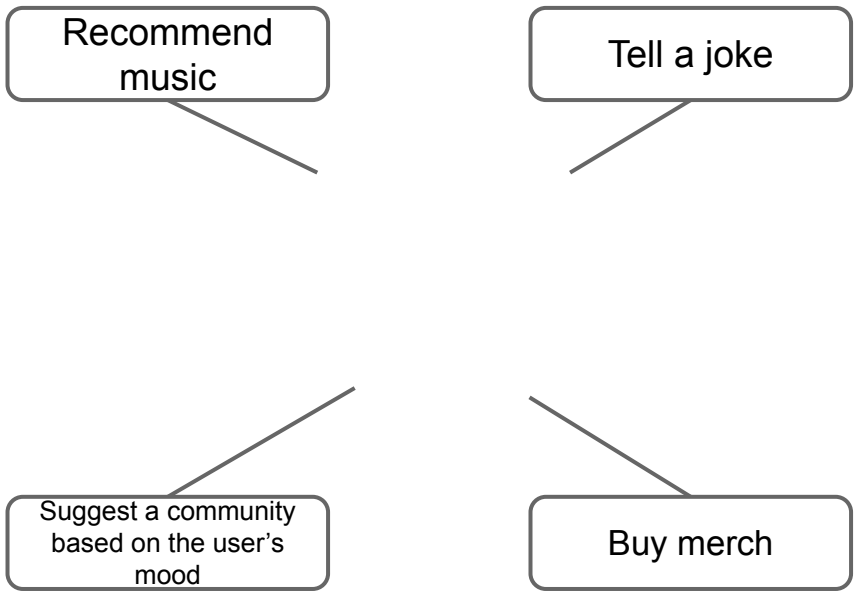
- keep up a conversation with the user and answer their questions;
- recommend entertainment and music.

Let’s try to figure out this task.

Emily,
Project Manager

Discussion of the tasks

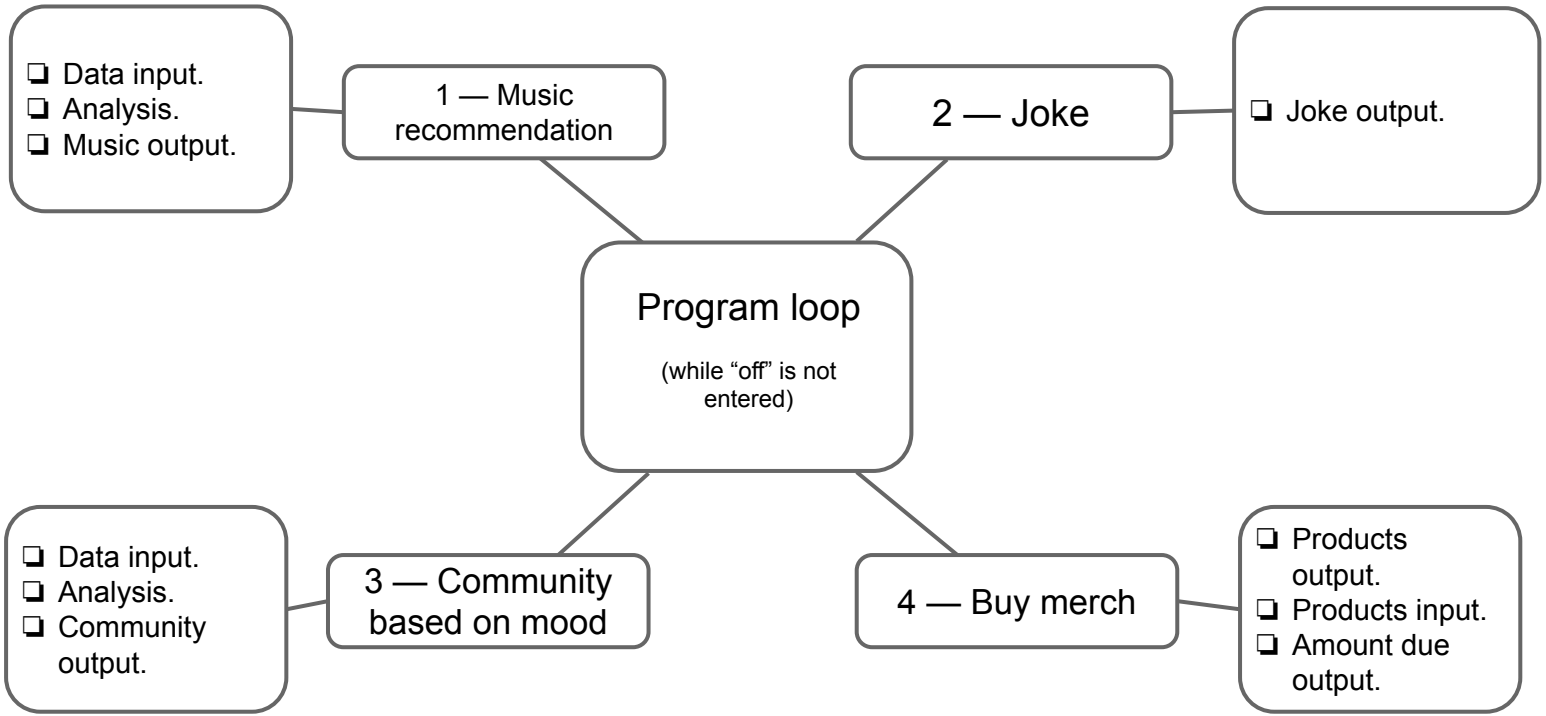
Textual helper bot



Let's assume Julia needs to have all this functionality.
How do we program such a spectrum of actions?

Discussion of the tasks

Textual helper bot



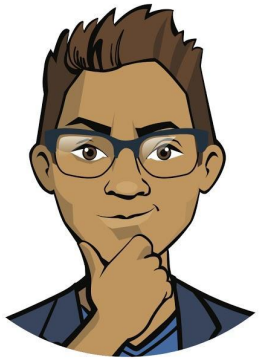
Almost every simple action needs to be designed as a separate program!

Discussion of the tasks

Nested constructs

We have already done a lot of work with control constructs. We've even placed one control construct inside another (a loop within a loop; a loop inside a conditional statement).

But programming this helper bot will require even more effort!



Cole,
Senior Developer

Discussion of the tasks

Training and hackathon

I suggest the following approach, beneficial for both the developers and the client:

- ➔ **Undergo training** to improve and consolidate our skills of programming nested constructs.
- ➔ Together with our colleagues, **take part in a hackathon** dedicated to programming the Julia bot.

  The best solution will then be delivered to the client!

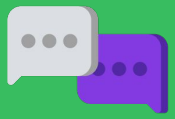
Discussion of the tasks

The goal of the workday is to

program the Julia helper bot using nested control constructs.

Today you will:

- learn new ways of using control constructs;
- undergo training on nested control constructs;
- program your own helper bot during the hackathon.



Discussion of the tasks

Confirmation of qualifications

To get started on the working tasks, demonstrate your knowledge level .

Prove that you are ready for the brainstorm and training!

Confirmation of qualifications

What is a conditional statement ?
What types of conditional statement s do you know?

Confirmation of qualifications

Conditional statement

– a command that executes or does not execute an action depending on the value of the logical expression.

```
if Expression is true :
    Execute action 1
    Execute action 2
    Execute action 3
```

An action block starts with a colon

4 spaces

```
if Expression_1 is true :
    Execute action 1
elif Expression_2 is true :
    Execute action 2
else :
    Execute action 3
```

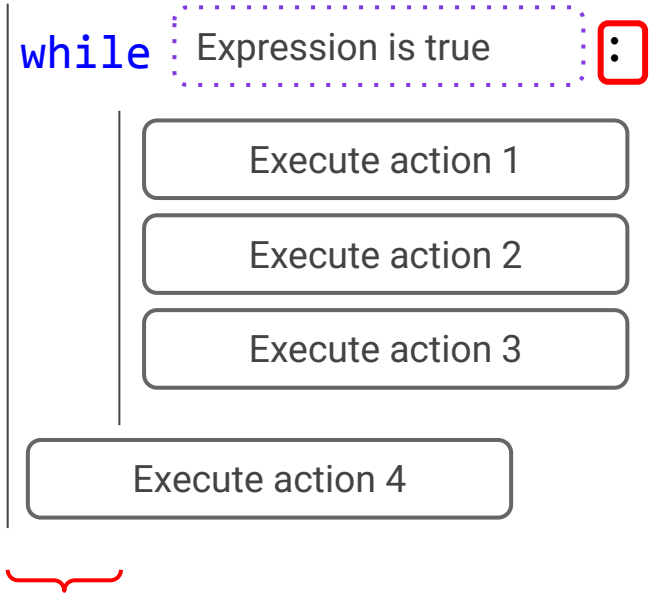
Confirmation of qualifications

What is a loop?
Which loop operators do you know?

Confirmation of qualifications

Loop

– a command that executes actions given as long as a certain logical expression remains true.



While the logical expression is true.

Execute...

Confirmation of qualifications

Loop

– a command that executes actions given as long as a certain logical expression remains true.

A sequence is an ordered set of elements.

```
for element in sequence :
    Execute action 1
    Execute action 2
    Execute action 3
Execute action 4
```

For every element in the sequence.

Execute...

Confirmation of qualifications

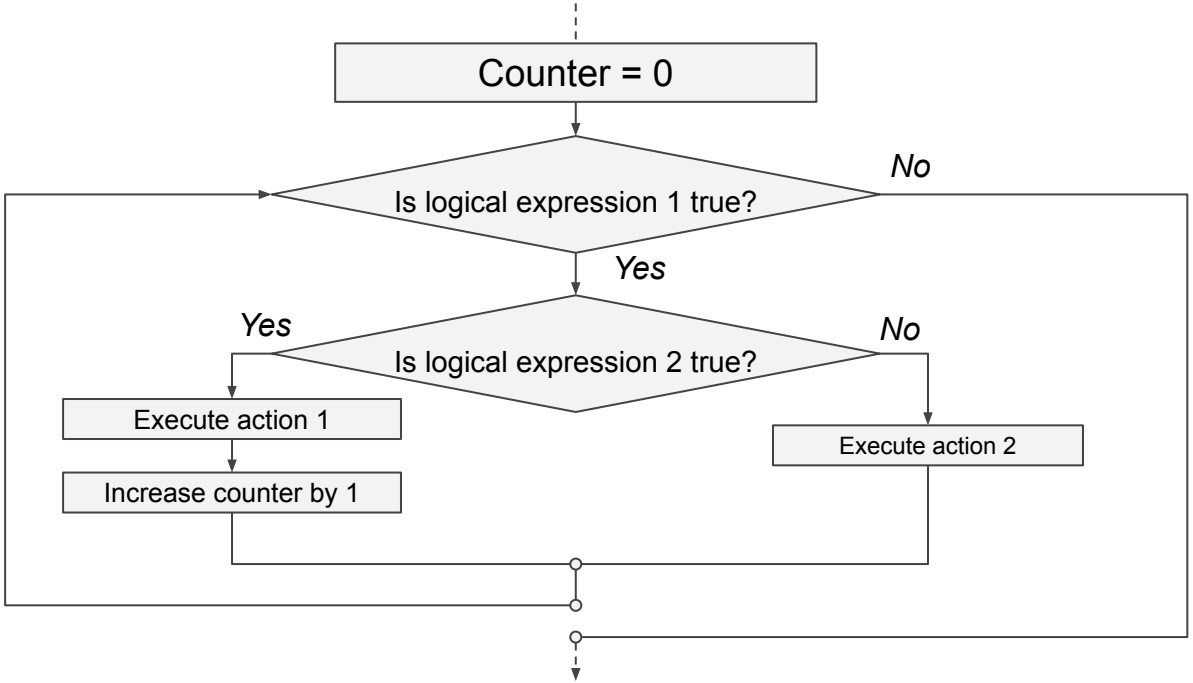
What is a counter ?
What data can it store?

Confirmation of qualifications

Counter

– a variable storing the number of steps of a certain loop.

Example:
Counter storing all the loop steps where the condition was true.



Confirmation of qualifications

How do we program
a while loop with a counter ?
A for loop with a counter ?

Confirmation of qualifications

while with counter

Counter to repeat the loop body n times.

```
i = 0

while i < n:
    Execute action 1
    Execute action 2
    i = i + 1
Execute action 3
```

Counter to count only the steps where the additional condition was true.

```
i = 0

while Expression_1 is true :
    if Expression_2 is true :
        Execute action 1
        i = i + 1
Execute action 2
```

Confirmation of qualifications

for with counter

`range(n)` — creates the sequence of numbers 0, 1, 2... n-1.

`range(a, b)` — creates the sequence of numbers a, a+1, a+2... b-1.

Counter to repeat the loop body n times.

```
for i in range(n):
    Execute action 1
    Execute action 2
    Execute action 3
Execute action 4
```

Repeat the loop body n times and count the number of times the additional condition was true.

```
k = 0
for i in range(n):
    If the condition is true
        k = k + 1
Execute action 2
```

Confirmation of qualifications

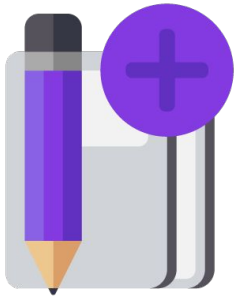
Qualifications confirmed!

Great! You are ready for the brainstorm and training!

Confirmation of qualifications

Brainstorm:

Training

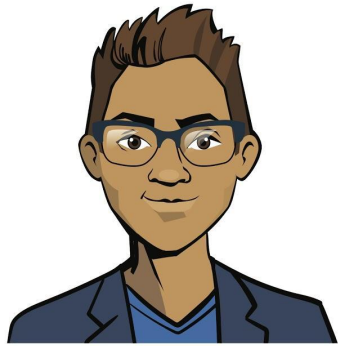


Nested control constructs

The training on nested data structures will consist of two parts: theory and practice.

Key question:

- What types of conditional statements and loops do we need to use in this particular task?



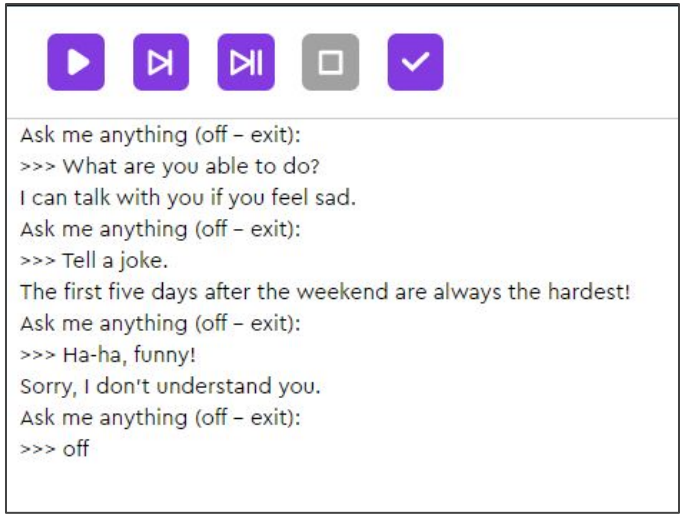
Brainstorm

Let’s go over a task

Task 1. Program a textual bot that can keep up a conversation. The bot must reply to these questions:

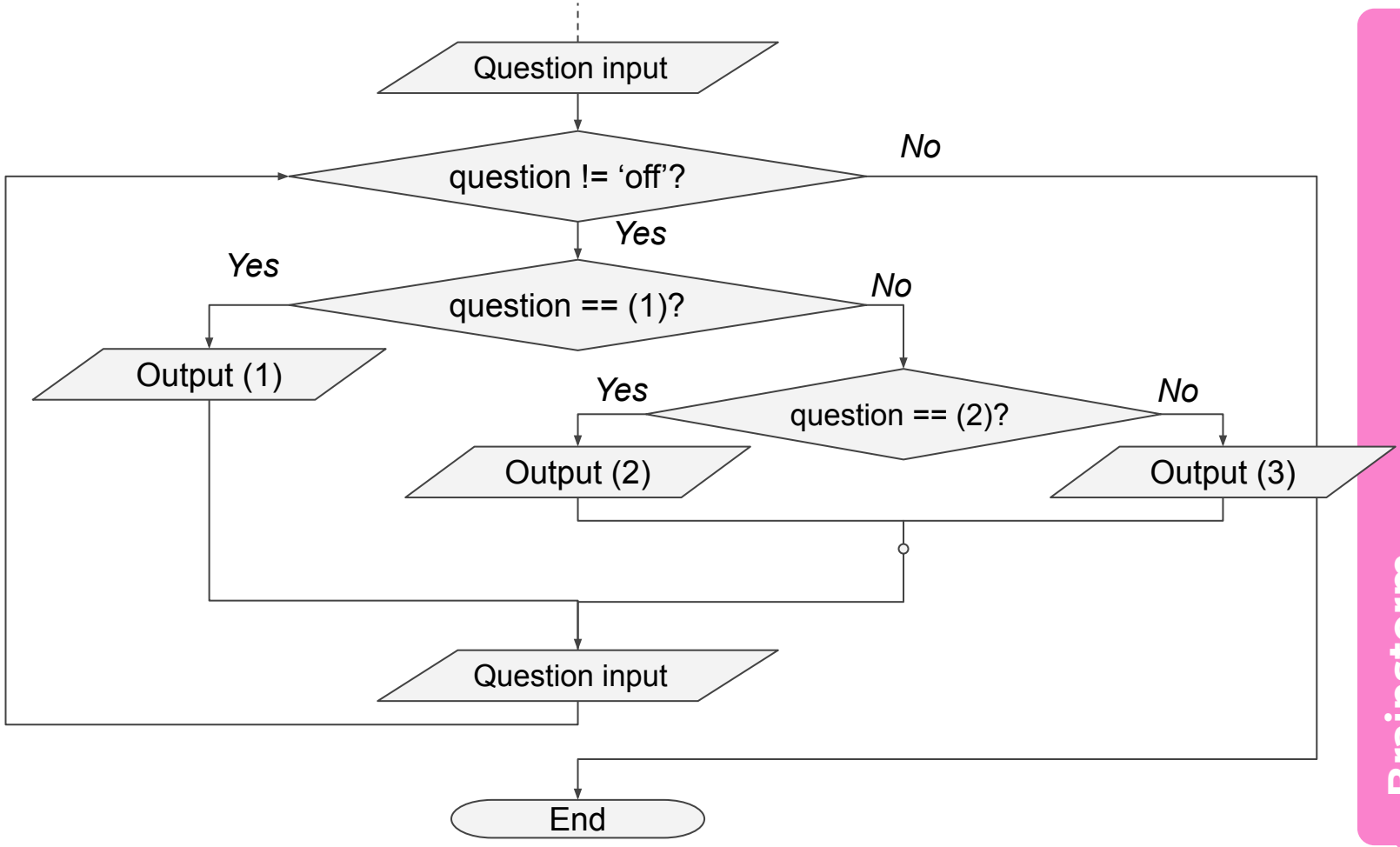
- Q: “What are you able to do?” A: “I can talk with you if you feel sad.”
- Q: “Tell a joke.” A: “The first five days after the weekend are always the hardest!”

In all the other cases: “Sorry, I don’t understand you.” When the input is “off”, the bot ends operation.



Which control constructs will we need?

Brainstorm


Question input
question != 'off'?
No
Yes
Yes
question == (1)?
No
Output (1)
Yes
question == (2)?
No
Output (2)
Output (3)
Question input
End

Brainstorm

Sample solution

Task 1. Program a textual bot that can keep up a conversation. The bot must reply to these questions:

- Q: “What are you able to do?” A: “I can talk with you if you feel sad.”
- Q: “Tell a joke.” A: “The first five days after the weekend are always the hardest!”

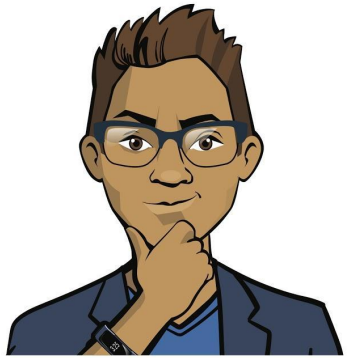
In all the other cases: “Sorry, I don’t understand you.” When the input is “off”, the bot ends operation.

```
question = input('Ask me anything (off - exit):')
while question != 'off':
    if question == 'What are you able to do?':
        print('I can talk with you if you feel sad.')
    elif question == 'Tell a joke.':
        print('The first five days after the weekend are always
the hardest!')
    else:
        print('Sorry, I don't understand you.')
    question = input('Ask me anything (off - exit):')
```

Brainstorm

Before we continue:

1. How will the program respond if the user inputs the following question: “What music is worth listening to?”
2. What addition do we need to make to the program so that, when asked, “What is your hobby?” the bot replies, “I love computer games”?
3. Trying to exit the program, users may enter “Off”, “OFF”, etc. instead of “off”.
   How do we recognize these, too?

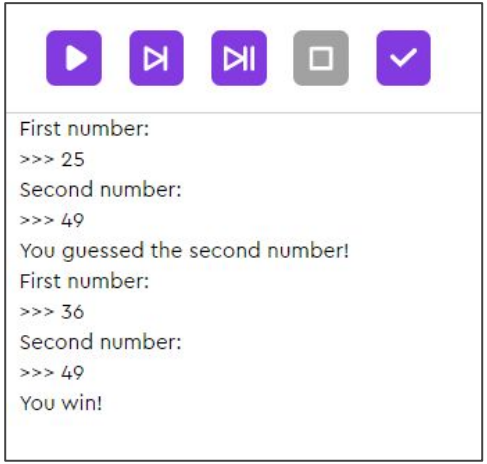


Brainstorm

Let’s go over a task

Task 2. The bot chooses two numbers a day. Those who guess both of them **in 3 tries** get a free music subscription for one year. Users enter these two numbers one after another.

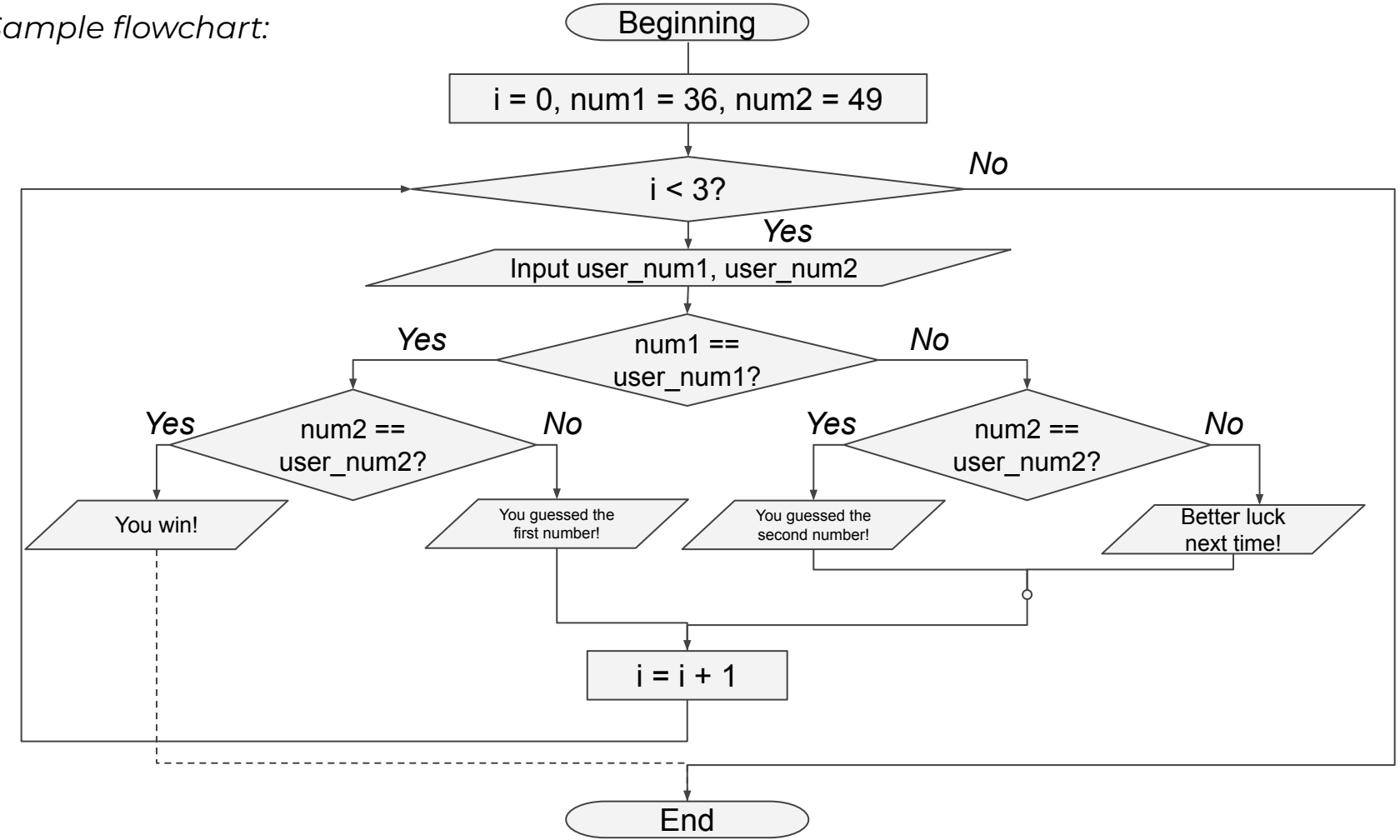
- ❏ If both of them are guessed correctly, the output is “You win!”
- ❏ If only the first one is guessed correctly, the output is “You guessed the first number!”
- ❏ If only the second one is guessed correctly, the output is “You guessed the second number!”
- ❏ In all the other cases, the output is “Better luck next time!”



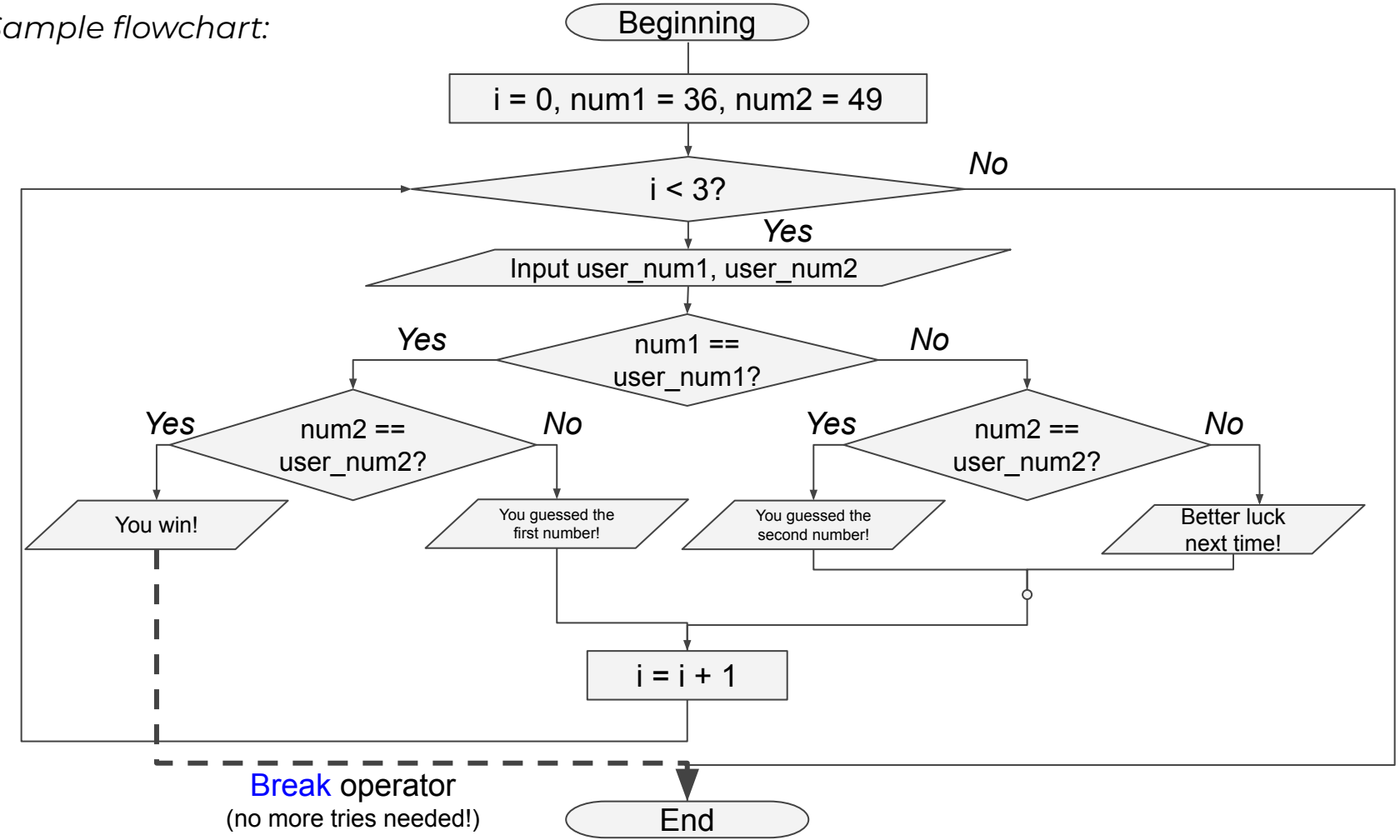
Which constructs will we need?

Brainstorm

Sample flowchart:



Sample flowchart:



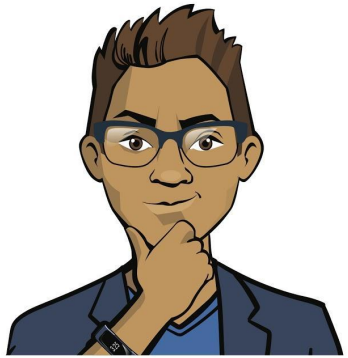
```
num1 = '36'
num2 = '49'
for i in range(3):
    user_num1 = input('First number:')
    user_num2 = input('Second number:')
    if user_num1 == num1:
        if user_num2 == num2:
            print('You win!')
            break
        else:
            print('You guessed the first
number!')
    else:
        if user_num2 == num2:
            print('You guessed the second
number!')
        else:
            print('Better luck next time!')
```

```
First number:
>>> 25
Second number:
>>> 49
You guessed the second number!
First number:
>>> 36
Second number:
>>> 49
You win!
```

Brainstorm

Before we continue:

1. How many levels of nesting are there in this program? Are there cases when the interpreter analyzes only part of the branches?
2. What will the program print if the user inputs the following sets of numbers?
    - 7, 49
    - 36, 46
    - 6, 7



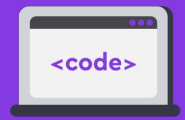
Brainstorm

Platform:

“Training”

Do the task on the platform

➡ “Training”

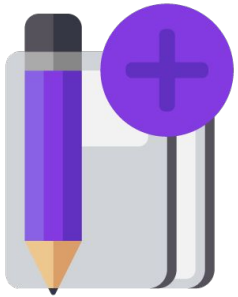


Training

Break

Brainstorm:

Hackathon



Hackathon rules

A hackathon is a competition among developers.

- Before a hackathon, the organizer suggests a project idea and the form in which that idea should be implemented.
- The participants then work on the idea for some time.
- At the end, the results are presented and discussed by both the judges and the participants.

Hackathons can be conducted in teams or individually.

Brainstorm

Hackathon rules

Today:

Organizer	The “Friend Around” social network with the support of ProTeam
Form of participation	Individual
Determining the winner	Based on the feedback from the hackathon participants and ProTeam representative in the Laboratory
Prize	The best solutions are delivered to the social network to be introduced into the product
Timing	20 minutes for development, 10 minutes for evaluation and results

Brainstorm

Hackathon task:

The goal is to program a bot that can:

- recommend entertainment activities;
- answer questions and keep up a conversation.

Follow the plan:

1. **Create** a new project in the Laboratory.
2. **Decide** what the bot will do: what questions it will answer and what entertainment it will suggest.
3. **Think** where you will use loops and where conditional statements will come in handy.
4. **Program** your own bot.

Don't forget to share your program with the other trainees and invite them to evaluate your code in the comments!

Brainstorm

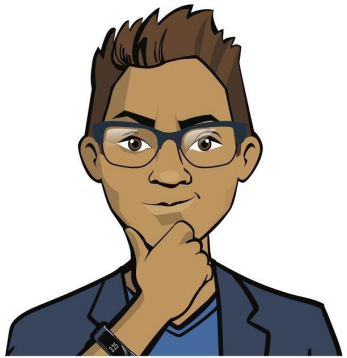
What must Julia be able to do?

The more interesting your bots are, the better!

For example, Julia may be able to:

- ❏ Recommend movies based on the user's mood.
- ❏ Recommend topic interest groups.
- ❏ Keep up a conversation and tell jokes.
- ❏ Tell the latest news.
- ❏ Invite the user to buy brand merch.

The only limitation is your imagination!



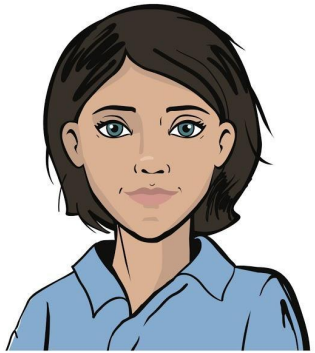
Brainstorm

Publish your solution in the Laboratory!

The **Laboratory** is an online software development environment.

In it, you can:

- program anything you want, not just ProTeam customer requests;
- share your programs with other ProTeam developers;
- like and comment on other students' projects.



Also, you can share your projects on Twitter,

Facebook, or other social media.

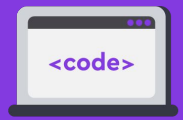
Brainstorm

Laboratory:

“Hackathon”

Do the task in the Laboratory

“Hackathon”

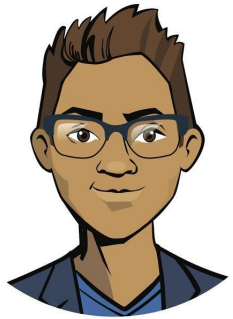


Hackathon

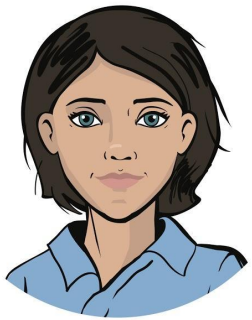
End of the workday

To wrap up the hackathon, provide your feedback:

1. How many of the other developers' projects have you looked at? Whose project did you like the most? Why?
2. Having seen some of the other solutions, what would you now improve in your own?

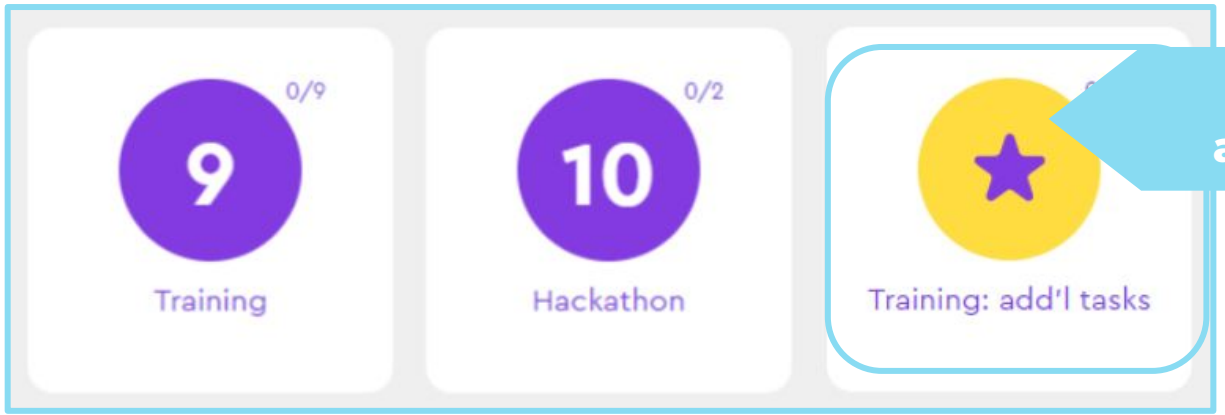


Cole,
Senior Developer

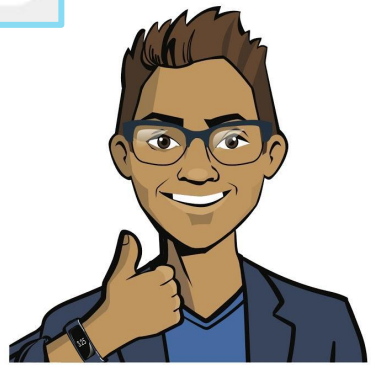


Emily,
Project Manager

Add'l tasks to improve efficiency



"Training: add'l tasks"



Wrapping up the workday