

DNAnalyzer - an online & interactive game on DNA data analysis

Albert-Ludwigs-Universität Freiburg



UNI
FREIBURG

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Introduction

DNA

RNA

Variants

Mutations

Sequencing

...

Introduction

DNA

RNA

Variants

Mutations

Sequencing

...

- **Street Science Community** - a group of researchers and teachers in Freiburg trying to bring DNA, sequencing, metagenomics and in general the scientific process closer to citizens.
- **DNAnalyzer** - an encouraging and easy-to-understand online game on DNA data analysis.

DNAnalyzer in the previous

Index page:

DNAnalyzer
Welcome to our online & interactive game on DNA data analysis

Let's start the Game!
Sam, a curious young alien robot from a faraway galaxy, invites you to discover a little blue planet in the Milky Way.

Level 1: Introduction

Sam will guide you through the game and you will learn about the Earth and life on it with him. Press the button to start.

Start

Results
Results of the games of all players are presented in the table below.

Username	Max Level	Final score
Pol	5	27
Pol2	3	20
d	3	26
e	3	16
Varya	2	14

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Quiz page:

DNAnalyzer
Level 2 - DNA

404 - Page Not Found
Oh nooooo... Page not found :(
The requested page could not be found.

Quiz
edwin@edwin@gmail.com (not shared) [Switch account](#) [Both names](#)
***Required**
Your Username (use the same Username at all levels!)*
edw
Next **Clear form**
View related resources through Google Forms
Google Forms This content is neither created nor endorsed by Google.

Next level

Results
Level 2

Username	Score
d	18 / 23
Pol2	11 / 23
e	9 / 23
h	9 / 23

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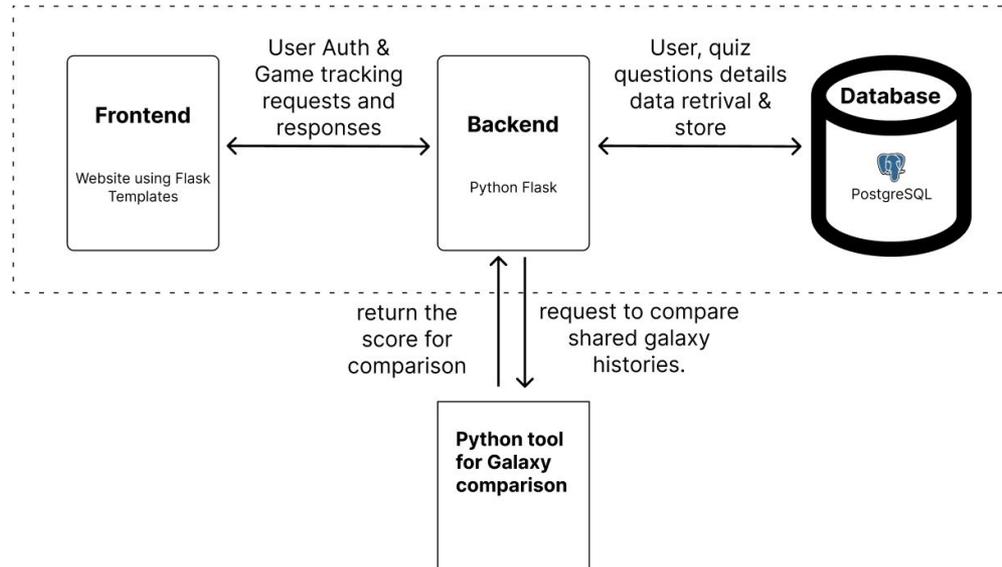
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My aims

1. Rewrite the website front-end.
 - a. Improve the website (clean design, layout, CSS, etc)
2. Develop a back-end to support
 - a. Our own login/sign-up system.
 - b. Serve quiz and results by itself instead of google forms.
3. Set up a database to
 - a. Store quiz questions, results and user informations.
 - b. Make it not too complex so contributor can submit new questions.
4. Integrate with existing game level 1 and set up the next level.
 - a. Integrate the Galaxy workflow comparison tool (Siyu's tool) to the level 2.
 - b. Make it easier to add new levels.

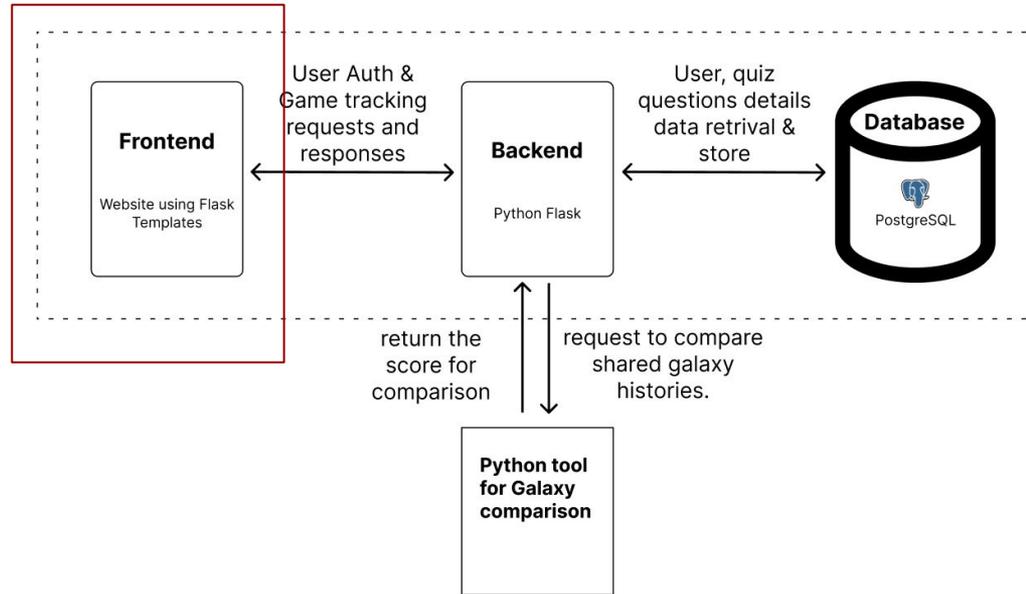
Website demo

Implementations



system architecture

Front-end

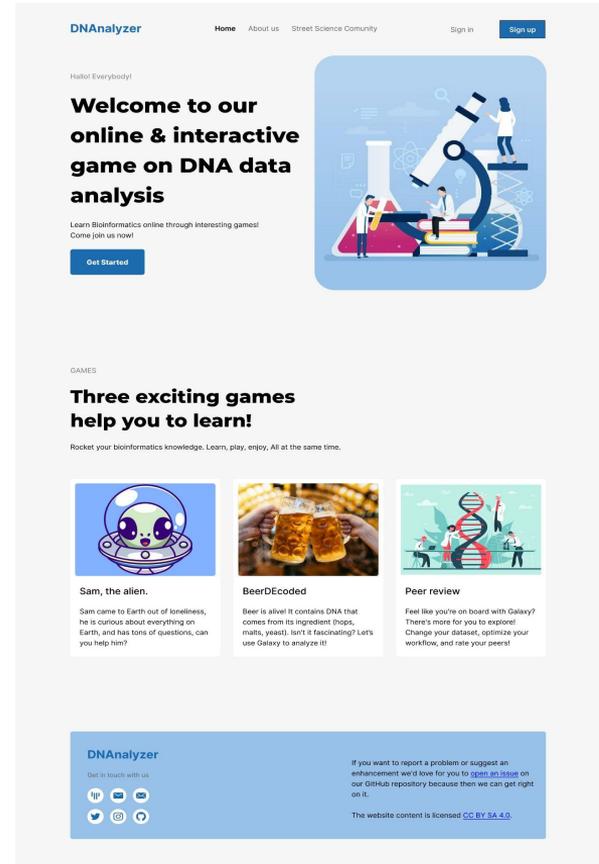


Front-end: Index Page

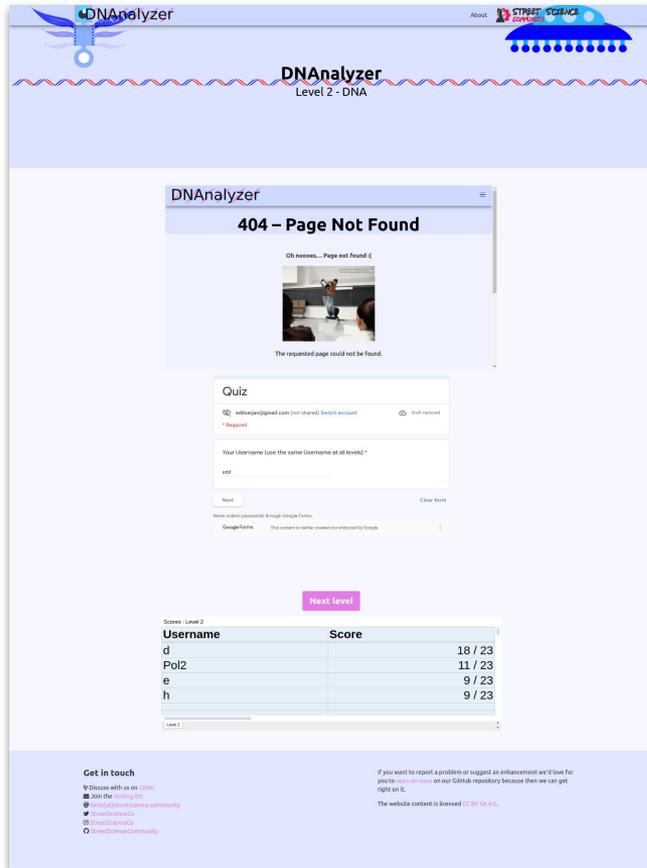


before:

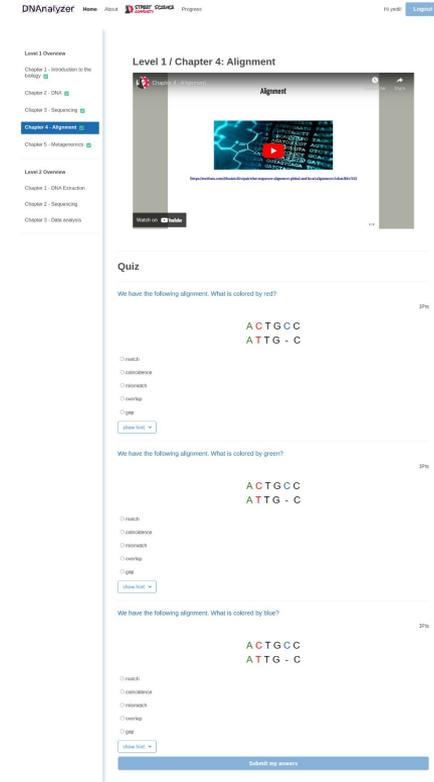
now:



Front-end: Quiz Page



before:



now:

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Front-end: Quiz Result Page

before:

Quiz
Total points 5/54

0 of 0 points

Your Username (use the same Username at all levels) *

hh

0 of 4 points

✗ What is the proper definition of evolution? *

0/4

changes in a population of organisms over a period of time

changes in individual organisms during their lifetime ✗

organisms coming into existence at a defined moment in time and not changing

Correct answer

changes in a population of organisms over a period of time

Feedback

Evolution is a change in a population of organisms through time leading to the appearance of new forms.

0 of 2 points

✗ What are biological survival benefits for a population? *

0/2

genetic disease

high mutation rate

environmental changes ✗

niche advantages like the lizards' ability to change a color

Correct answers

high mutation rate

niche advantages like the lizards' ability to change a color

Feedback

Mutations occur throughout the natural world. Some mutations are beneficial and increase the possibility that an organism will thrive and pass on its genes to the next generation. When mutations improve survival or reproduction, the process of natural selection will cause the mutation to become more common over time. Therefore, mutations can be bad for the individual but overall beneficial for a population. Niche properties like the color changing of lizards can be crucial for their survival. They are not as easy to find by animals who would like to eat them and therefore can survive longer than other species.

now:

DNAnalyzer
Home About Progress
Hi user [Logout](#)

Level 1 Overview

Chapter 1 - Introduction to the subject

Chapter 2 - DNA

Chapter 3 - Sequencing

Chapter 4 - Alignment

Chapter 5 - Metagenomics

Level 2 Overview

Chapter 1 - DNA Extraction

Chapter 2 - Sequencing

Chapter 3 - Data analysis

Level 1 / Chapter 5 Quiz result 24 / 18 points

How is the research area called where environmental samples are analyzed for genetic diversity? 3/5

Biology Mining

Bioinformatics

Metagenomics Mixed Answer

Genetics

Explanation

Metagenomics is the study of genetic material recovered directly from environmental samples. Biology is a branch of science that deals with living organisms and their vital processes. Bioinformatics is an interdisciplinary field that combines general biology, molecular biology, cybernetics, genetics, chemistry, computer science, mathematics and statistics. Genetics is an interdisciplinary field of biology focusing on the structure, function, evolution, rearing, and coding of genomes.

What can we use to detect and identify different types of microbes stemming from an environmental sample? 3/5

metagenome

DNA extractor Correct

DNA sequencing Mixed Answer

Explanation

The samples are sent to a laboratory for DNA extraction and sequencing.

Here are all steps of a metagenomics experiment listed. Please sort them into the correct order (steps). 3/5

	collecting samples	assembly	DNA sequencing	classifying	annotation	analysis
Step 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Step 2	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Step 3	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Step 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Step 5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Step 6	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Where can we collect samples for a metagenomics analysis? 3/5

Soil Mixed Answer

Water Mixed Answer

Air Correct

Gut Correct

Urine Correct

Explanation

Samples can be collected anywhere.

Retry

Top 5 rankings on Chapter 5

username	score	Finished Time
user2	24	2022-08-11 05:53:14
user	18	2022-08-11 07:02:41

Get in touch

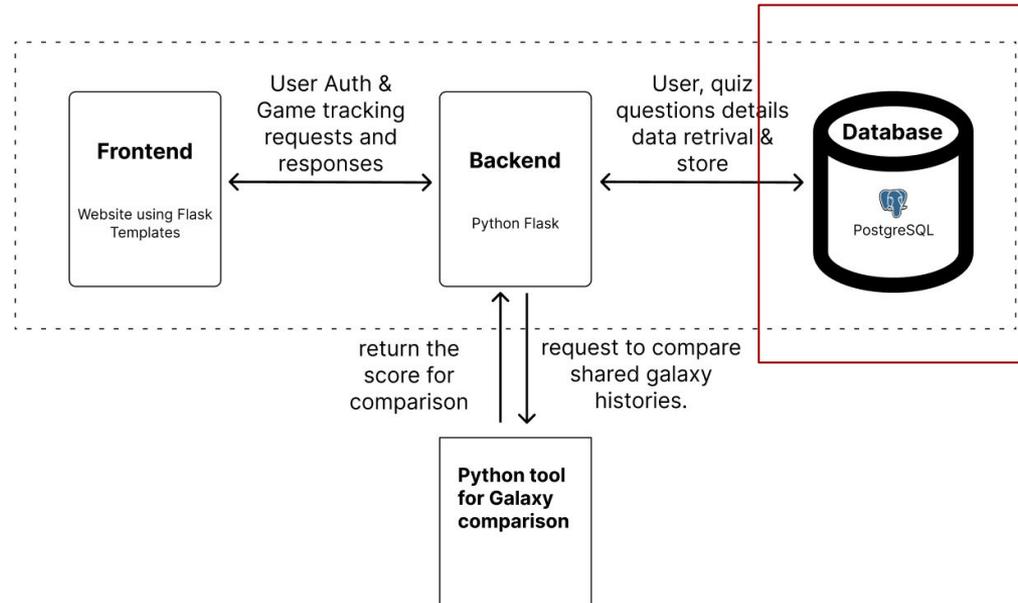
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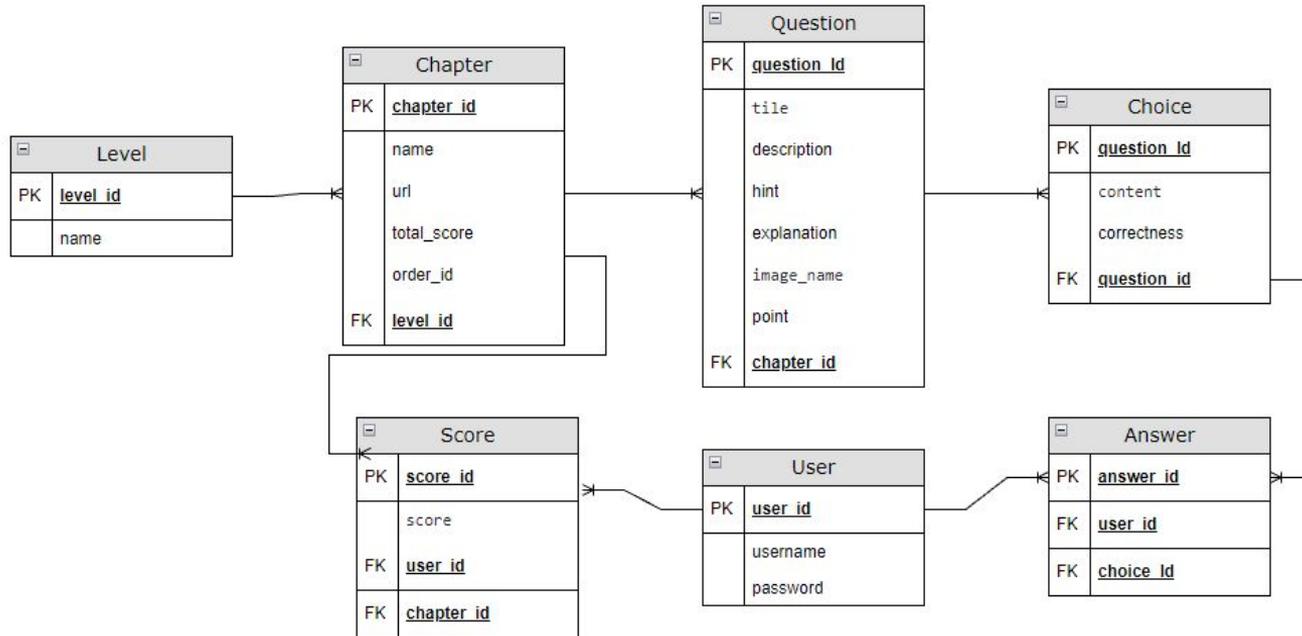
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11

Database



Database



relational diagram

Yaml file

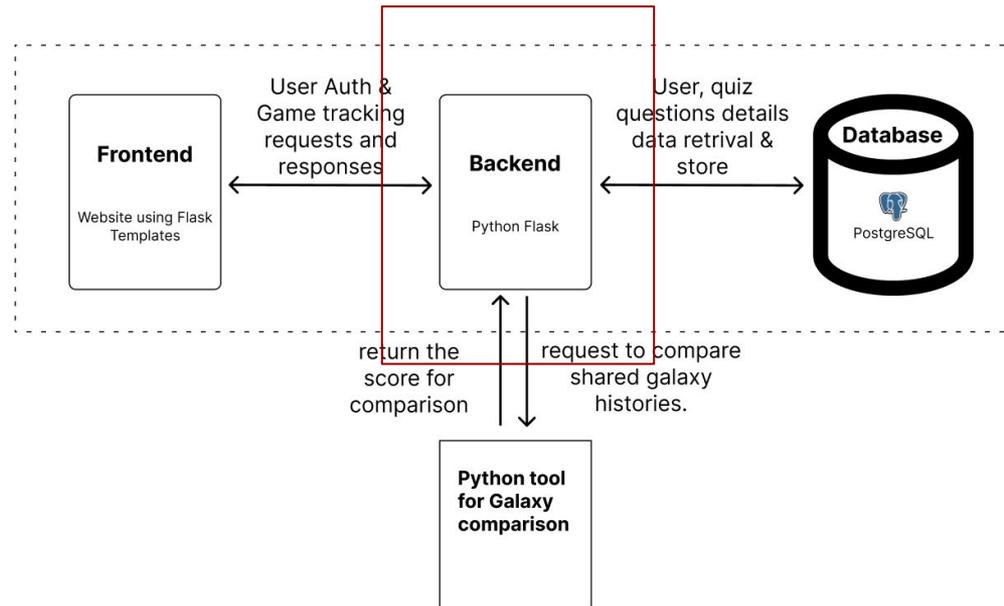
```
chapter_name: Introduction to the biology
video_url: Y_8SuKF-YHY

total_score: 54

questions:
# 1
- title: What is the proper definition of evolution?
  type: choose_one
  hint: Even though evolution is taking place all around us...
  explanation: Evolution is a change in a population of organisms...
  image_name:
  point: 4
  choices:
    - 1: changes in a population of organisms over a period of time
      correct: true
    - 2: changes in individual organisms during their lifetime
      correct: false
    - 3: organisms coming into existence at a defined moment in time...
      correct: false
```

Quiz yaml file example

Back-end



Github and documentations

- Github (<https://github.com/StreetScienceCommunity/DNAnalyzer>):
 - Code repository
 - Pull requests
 - Issues
 - Code reviews
- Documentations
 - Code comments
 - Readme file
 - Deployment instructions
 - Contribution instructions
 - Database designs
 - User interface designs

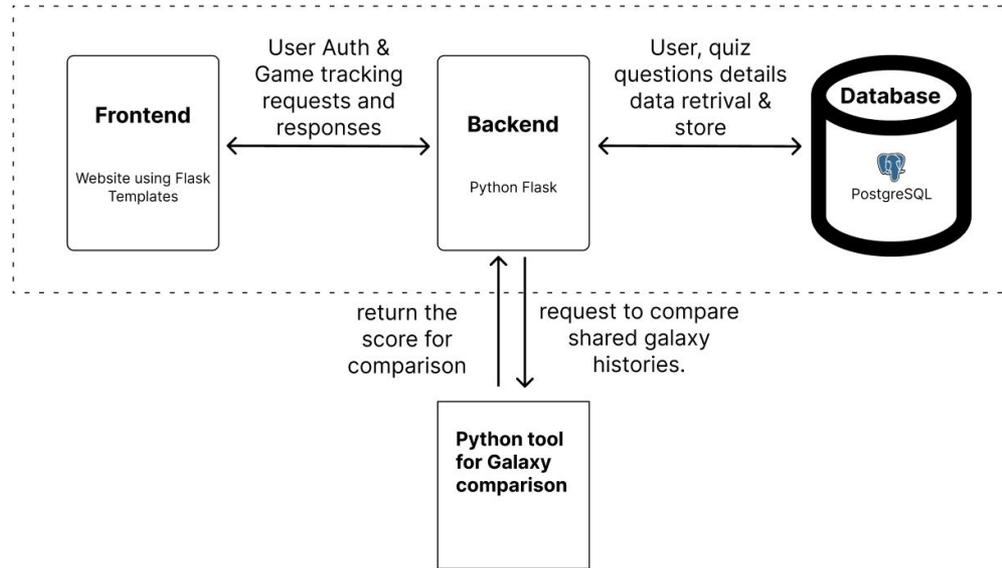
What missing now?

- Integration with galaxy workflow evaluation tool
- Deployment on a server

Future development

- Level 3 of the game

Summary



Thank You!