JETBRAINS

JetBrains X GEHACK First Year Programming Contest

Mikhail Ushakov
Intern at Code Platform

About Me

- Intern, Code Platform team @ JetBrains
- 2nd-year CS Master’s student @ Radboud University
- Founder of an IT startup :)
- 10+ years of programming experience
- Background in competitive programming

JetBrains Internships

Application Process

- Project-based
- Paid internships
- Part-time and full-time opportunities
- Offices in Amsterdam

IMPORTANT: Applications deadline is 08.05!

JetBrains Internships

Application Process

Apply →

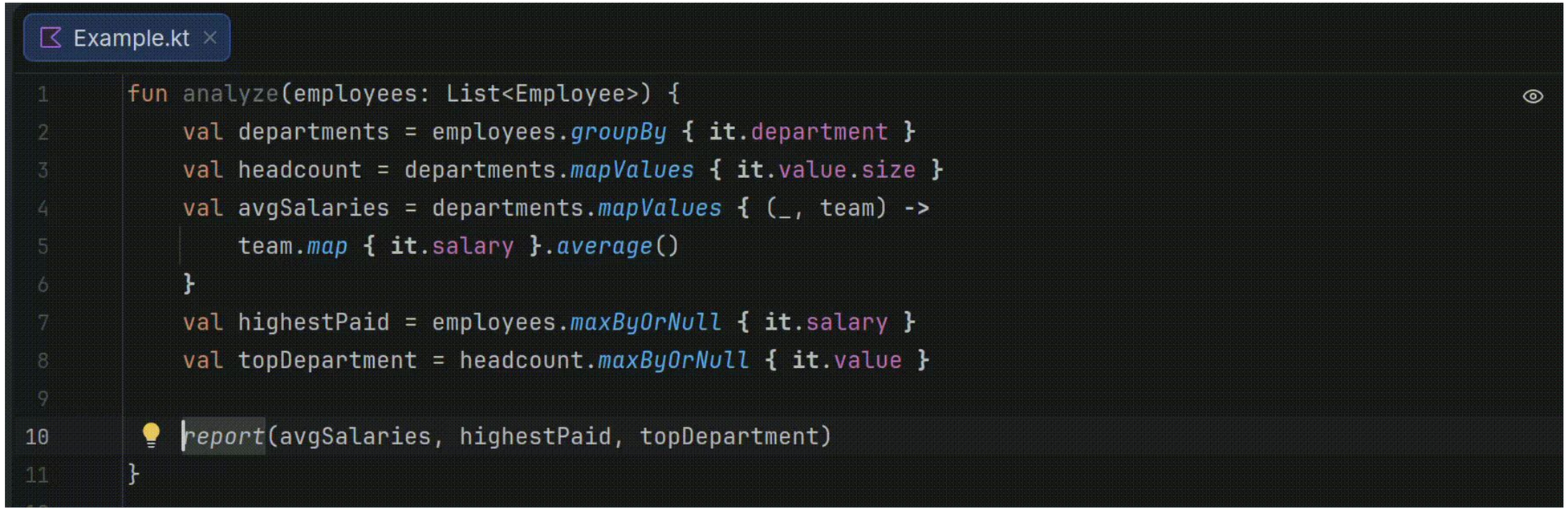
Test Task →

Interview →

Start! 🧑‍💻

IMPORTANT: Applications deadline is 08.05!

What Interns Actually Do



X-Ray Mode for Kotlin in IntelliJ Idea

What Interns Actually Do

```
println(
    6L.apply { this: Long
        'x'.apply { this: Char
            code + div( other = 1)
        }
        inc() - dec()
    }
)
```

VS

```
println(
    6L.apply { this: Long
        'x'.apply { this: Char
            this@Char.code + this@Long.div( other = 1)
        }
        this@Long.inc() - this@Long.dec()
    }
)
```

Clickable inlay hints for implicit receivers in scope functions

The most important skill for competitive programming

READING

The most important skill for competitive programming

Reading Tips

- Problem statement = encoded mathematical model
- Discard as many unnecessary details as possible
- Try to explain the problems statement to your teammate
- Shorter + Simpler = Better

Quiz

Which of the following are part of the problem statement?

Input limitations ✅

Sample inputs & outputs ✅

Some *sTrAnGe* detail ✅

Small notes under the examples ✅

Write a Good Template (.cpp)

- Create a small tested template
- Include ***fast*** input/output
- Include common imports

- For Java: DO NOT USE “Scanner”!

```cpp
#include <bits/stdc++.h>

using namespace std;

int main() {
    ios::sync_with_stdio(0);
    cin.tie(0);
    cout.tie(0);

    // solve here
}
```

Write a Good Template (.kt)

```kotlin
@JvmField
val INPUT = System.`in`

@JvmField
val OUTPUT: OutputStream = System.out

@JvmField
val reader = INPUT.bufferedReader()

fun readLine(): String? =
reader.readLine()

fun readLn() = reader.readLine()!!


@JvmField
val writer = PrintWriter(OUTPUT, false)

inline fun output(block: PrintWriter.() -> Unit) {
    writer.apply(block).flush()
}
```

```kotlin
@JvmField
var tokenizer: StringTokenizer = StringTokenizer("")

fun read(): String {
    while (tokenizer.hasMoreTokens().not()) {
        tokenizer = StringTokenizer(
            reader.readLine() ?: return "",
            " "
        )
    }
    return tokenizer.nextToken()
}

fun readInt() = read().toInt()
fun readDouble() = read().toDouble()
fun readLong() = read().toLong()
// ... And more ...
```

Write a Good Template (.java)

```java
import java.io.BufferedReader;
import java.io.IOException;
import java.io.InputStreamReader;
import java.nio.charset.StandardCharsets;
import java.util.StringTokenizer;

public class Solution {
    BufferedReader in = new BufferedReader(new InputStreamReader(System.in, StandardCharsets.UTF_8));
    StringTokenizer st;
    public void solve() throws IOException { /* solution here */ }
    String nextToken() throws IOException {
        if (st == null || !st.hasMoreTokens()) { st = new StringTokenizer(in.readLine()); }
        return st.nextToken();
    }
    int nextInt() throws IOException { return Integer.parseInt(nextToken()); }
    public static void main(String[] args) throws IOException { new Solution().solve(); }
}
```

Write a Good Template (.py)

```python
import sys

def input():
    return sys.stdin.readline().strip()

def main():
    # solve here
    pass

if __name__ == "__main__":
    main()
```


O(2^n)
Wait, SpongeBob! We're not cavemen.


We have
Polynomial Algorithms


O(n^100000)

Quiz: Will it Pass?

Round 1

Input: n ≤ 1 000 000

TL: 1 second

```
long long sum = 0;
for (int i = 0; i < n; i++) {
    sum += a[i];
}
```

Answer:

- Complexity: O(n)
- #Operations: 1 000 000
- Verdict: ✅

Quiz: Will it Pass?

Round 2

Input: n ≤ 100 000

TL: 1 second

```
bool found = false;

for (int i = 0; i < n; i++) {
    for (int j = i + 1; j < n; j++) {
        if (a[i] == a[j]) found = true;
    }
}
```

Answer:

- Complexity: O(n^2)
- #Operations: 10 000 000 000
- Verdict: ❌

Quiz: Will it Pass?

Round 3

Input: n ≤ 200 000

TL: 1 second

```
sort(a.begin(), a.end());

for (int i = 1; i < n; i++) {
    if (a[i] == a[i - 1]) {
        cout << "YES\n";
        return 0;
    }
}
cout << "NO\n";
```

Answer:

- Complexity: O(n log n)
- #Operations: ~3 700 000
- Verdict: ✅

Quiz: Will it Pass?

Round 4

Input: n ≤ 500

TL: 1 second

```
int answer = 0;

for (int i = 0; i < n; i++) {
    for (int j = 0; j < n; j++) {
        for (int k = 0; k < n; k++) {
            answer += check(i, j, k);
        }
    }
}
```

Answer:

- Complexity: O(n^3)
- #Operations: 125,000,000
- Verdict: 🤔

How to Decide in a Contest?

- Read input limits (... ≤ n ≤ ...)
- Read time limits (Time limit: ...)
- Estimate the complexity
- Calculate the number of operations
- Compare with the time limits

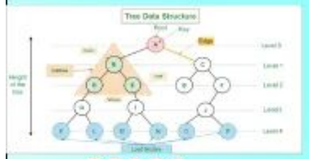
Rule of thumb: 1 second TL usually allows for 10^7-10^8 operations

Stop using Data Structures

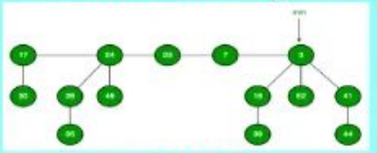
- Trees were not meant to require a bachelor degree to understand
- Years of studying data structures but no real world usage found other than on exam papers
- Wanted to store data anyway for a laugh? We had a tool for that: it is called ARRAYS
- "Let's implement a Circular Doubly Linked List with a dummy node" - Statements dreamed up by the utterly Deranged.

Look at what software engineers has been demanding you to respect for all this

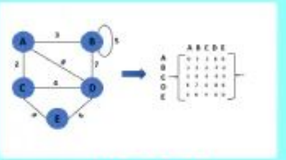
(This is REAL Data structures, used by REAL software engineers)



?????

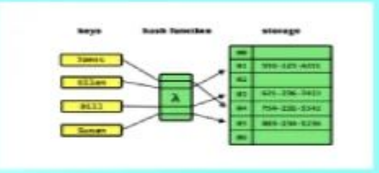


?????



?????

Hello, I would like



please

They have played us for absolute fools.

Quiz: Pick the Container

Round 1

Teams at coding competition submit solutions.

We need to count:
how many accepted problems each team has?

array / set / map / stack / queue

Quiz: Pick the Container

Round 1

Teams at coding competition submit solutions.

We need to count:
how many accepted problems each team has?

array / set / **map** / stack / queue

Quiz: Pick the Container

Round 2

Students at Eindhoven university register for the competition with very creative team names.

We need to know if a team name was already used.

array / set / map / stack / queue

Quiz: Pick the Container

Round 2

Students at Eindhoven university register for the competition with very creative team names.

We need to know if a team name was already used.

array / **set** / map / stack / queue

Quiz: Pick the Container

Round 3

Our code is full of brackets:

```
if (...) { while (...) [...] }
```

We want to check whether every opening bracket
is correctly closed.

array / set / map / stack / queue

Quiz: Pick the Container

Round 3

Our code is full of brackets:

```
if (...) { while (...) [...] }
```

We want to check whether every opening bracket
is correctly closed.

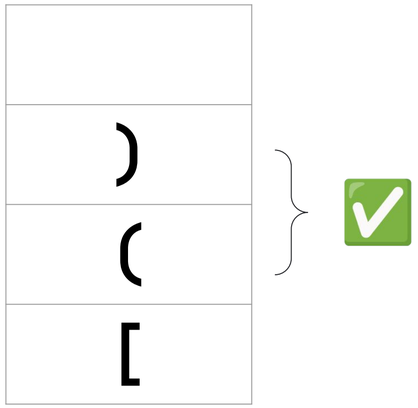
array / set / map / **stack** / queue

Quiz: Pick the Container

Round 3

```
[1,(x + 1),2]
```

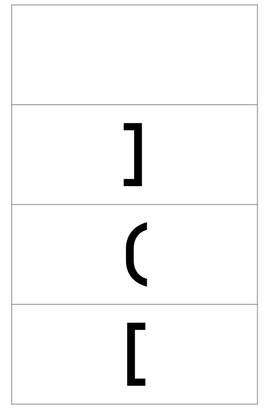
```
  ^
```



✅

```
[1,(y + 2]
```

```
  ^
```



❌

array / set / map / **stack** / queue

Quiz: Pick the Container

Round 4

Balloon requests arrive to the contest team in order.

We want to hand out balloons in the correct order.

array / set / map / stack / queue

Quiz: Pick the Container

Round 4

Balloon requests arrive to the contest team in order.

We want to hand out balloons in the correct order.

array / set / map / stack / **queue**

Containers: Summary

I need to…	**Then you should use…**
Store values in order	`array` or `vector`
Check if something appeared before	`set`
Count objects or store (key → value) pairs	`map` or `dictionary`
Process the latest item first	`stack`
Process the first item first	`queue`

Contest Checklist!

Submitted to the wrong problem	The shortest problem hurts most	Solved it with graphs	Solved 3+ problems with Python	Infinite recursion
2+ solves in the last hour	Changed programming language	Forgot long long	Got the first balloon	Missed one edge case
Can't decide who types	Easy problem took 5+ tries	Free!	Memory limit exceeded	"Can I solve this in Rust?"
Following scoreboard gossip	Off-by-one error	"Easy fix" took 1+ hour	Team mascot spotted	Brute force worked
Floating point problems	WA on sample input	Someone used Kotlin	One-formula solution	Came mostly for the food

Thank you
and good luck!

Mikhail Ushakov
mikhail.ushakov@jetbrains.com / mikhirurg.nl