

# Judger API

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## Introduction

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A sandbox of judger. With the input `solution_id`, the judger would return the result of the code according to this `solution_id`.

The judger is implemented using python with django.

## Principle

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The total working steps of the judger can be separated into 5 parts: searching information, output code as a file, compile code, run code and compare output.

### Searching information

The judger client maintains a queue of `solution_id`. With something in the queue, the judger would automatically search the database in order to get all the information needed. If the queue is empty, the judger would search the database to prevent some submission from mission.

```
OJ_DB = DB(DATABASES_HOST, DATABASES_USER, DATABASES_PWD, DATABASES_DB)
list = OJ_DB.search_submission()
queue_lock.acquire()
for i in range(0, len(list)):
    self.task_queue.put(list[i])
queue_lock.release()
```

### Output, compile and run

Because the code is stored in database and it is almost impossible to compile a string, we have to output the code string got from the database to a file. After outputting the string, the judger would call the system command to compile and run the code.

```
def output_Code(self, code, language_config):|...

def compile(self, language_config, append=None):...

def run_code(self, language_config, problem_id, time_limit, memory_limit):...
```

### Compare user output with the standard output

There are two kinds of circumstance in this step: ordinary judge and special judge. It is easy to implement the ordinary judge with the I/O operation. For the special judge, a `spj.cc` code is needed. The contrast is done by the `spj.cc`. The only one thing the judger should do is to compile and run the `spj.cc`. The return value of the `spj.cc` determine the correctness of the user output.

```
def compare_output_spj(self, output_folder, standard_output_folder):...  
  
def compare_output(self, output_folder, standard_output_folder):...
```

## Difficulty

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**How to prevent the server from being attacked by some malicious code like `os.system('rm -rf /*')`?**

Using docker. The docker container would bear most of the attack from malicious code.

**How to judge the TLE and MLE?**

For TLE, it is useful to run the code with a thread. Before the code running, the `timeoutThread` would be started. In the `timeoutThread`, it would judge whether time out.

For MLE, it is useful to run the code with a process. We can easily get a memory occupation with some system command in Linux. However, in python, there is a powerful package could be helpful, which is `psutil`. It can easily get all of the information with a pid. So, in the docker, the judger would start a process and a listener listening to the process and return the corresponding result.

```

class SourceListener(threading.Thread):
    def __init__(self, time_limit, memory_limit, process, initial_memory):
        super().__init__()
        self.time_limit = float(time_limit)
        self.initial_memory = initial_memory
        self.process = process
        self.memory_limit = memory_limit

    def run(self):
        global result
        global taskThread_end
        global source_listener_end
        max_memory = -1
        startTime = time.time()
        while time.time() - startTime <= self.time_limit and not taskThread_end:
            if not taskThread_end:
                memory = self.process.memory_info().rss
                max_memory = max(max_memory, memory)
                if memory - self.initial_memory >= int(self.memory_limit):
                    lock.acquire()
                    result['MLE'] = True
                    result['memory'] = memory - self.initial_memory
                    taskThread_end = True
                    lock.release()
            lock.acquire()
            if taskThread_end:
                result['time'] = time.time() - startTime
            else:
                result['TLE'] = True
                result['time'] = self.time_limit + 0.1
                taskThread_end = True
            result['memory'] = max_memory - self.initial_memory
            source_listener_end = True
            lock.release()

```

## To do next

1. Connect the judger and the back end with **Message queue** or modify the judger as a web api.
2. Encapsulation the judger.