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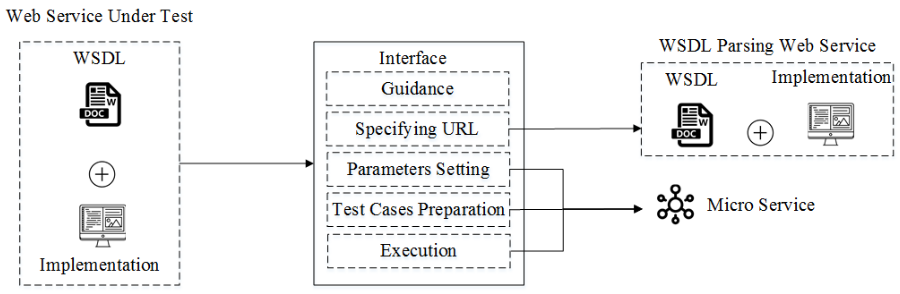
DRTester

The prototype tool *DRTester* can test web services using dynamic random testing technique. We describe the implementation and configuration of the tool in detail.

Framework of DRTester



The above figure illustrates the *DRTester* framework, comprising four main parts, corresponding to the left of web service is the testing target; *interface* is the interface between the user and *DRTester*; the top right of web service is responsible to parse the address of the target web service's wsdl, and return information (such as methods and parameters) to *micro services* that are used to partition input domain, generate test cases, execute test case, and send information to *interface*.

We next examine each component in the framework individually.

Interface

We developed a html page by using the Vue framework (https://cn.vuejs.org/), the source code of which can be obtained by visiting https://github.com/phantomDai/DRTester.git.

Once downloading the source code, the user needs to set up the local environment as follows:

1. download and install *node.js*
2. execute the following command in DOS:

   ```
   npm install vue -g
   ```

3. execute the command: npm install vue-cli -g

   ```
   npm install vue-cli -g
   ```

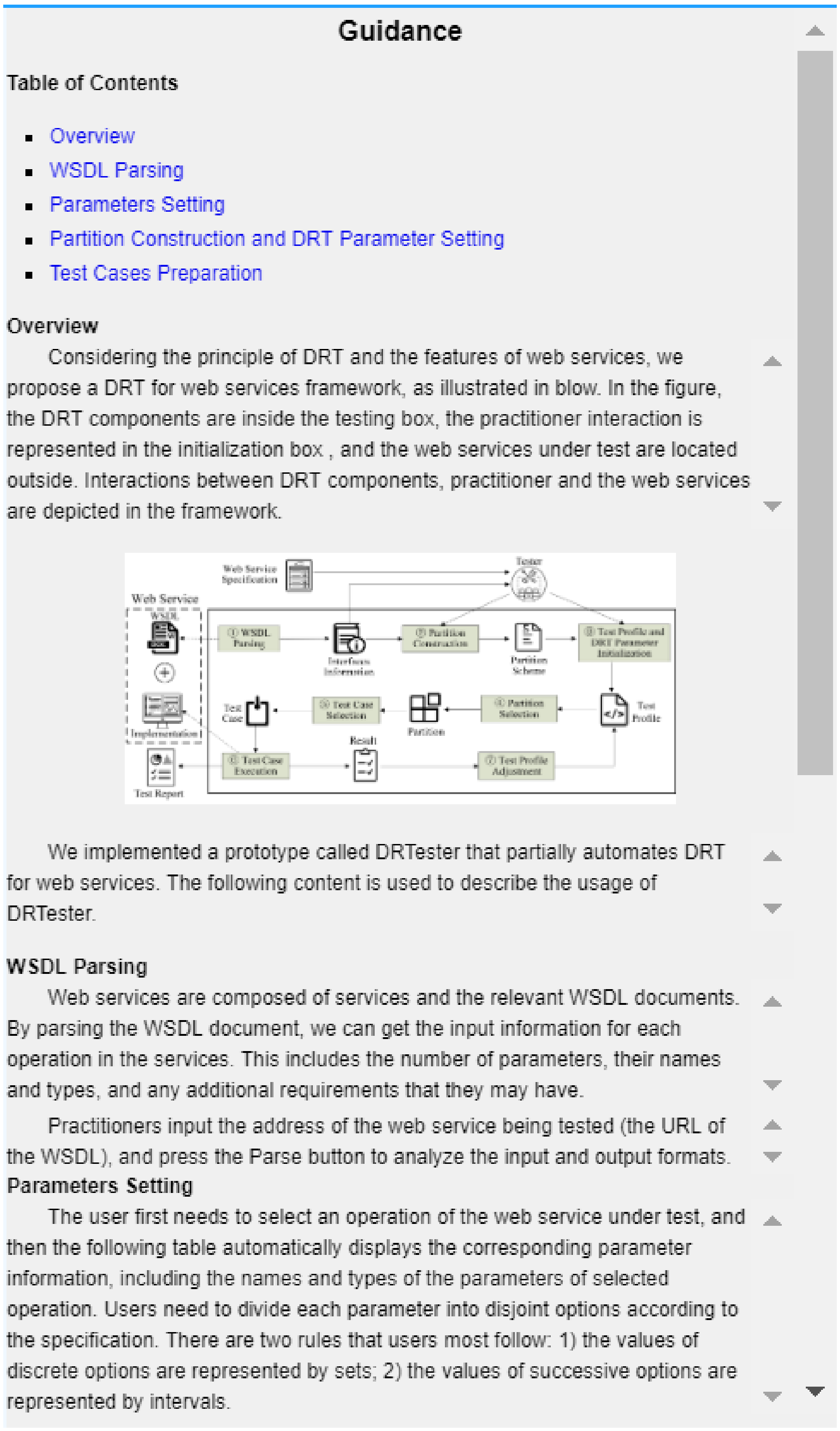
Note that if the user is in China, execute the following command in DOS after finishing step 1.

```
npm install -g cnpm --
registry=https://registry.npm.taobao.org
```

After the environment is configured, the user first need to go to the downloaded files directory and create "node_modules" directory, then execute the following command:

```
#  if you are not in China, you can just execute the
#  following command in DOS
npm install
npm run dev
#  if you are in China, you can just execute the following
#  command in DOS
cnpm install
npm run dev
```

After the user completes the above steps, he can enter http://localhost:8080 in his browser. Accordingly, the *Guidance* page is visible, describes the steps users should follow when testing a web service.



Guidance

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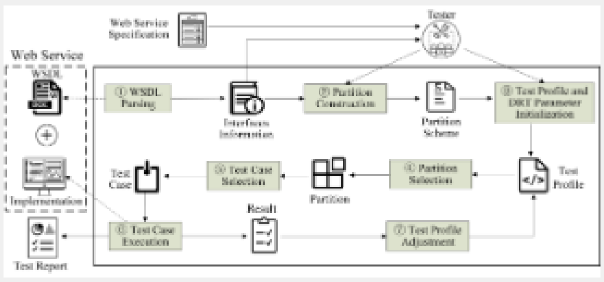
Overview

Considering the principle of DRT and the features of web services, we propose a DRT for web services framework, as illustrated in blow. In the figure, the DRT components are inside the testing box, the practitioner interaction is represented in the initialization box , and the web services under test are located outside. Interactions between DRT components, practitioner and the web services are depicted in the framework.



We implemented a prototype called DRTester that partially automates DRT for web services. The following content is used to describe the usage of DRTester.

WSDL Parsing

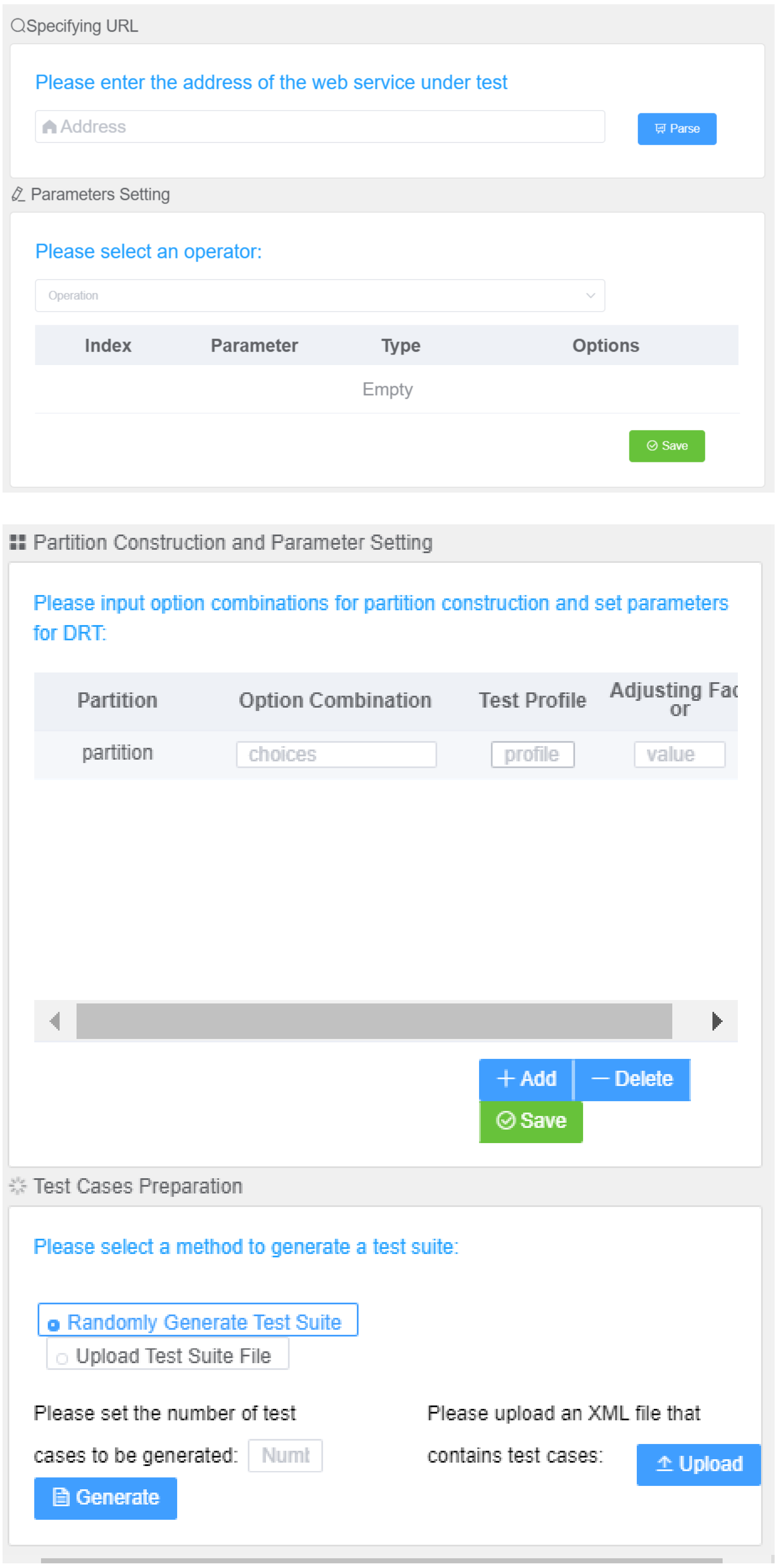
Web services are composed of services and the relevant WSDL documents. By parsing the WSDL document, we can get the input information for each operation in the services. This includes the number of parameters, their names and types, and any additional requirements that they may have.

Practitioners input the address of the web service being tested (the URL of the WSDL), and press the Parse button to analyze the input and output formats.

Parameters Setting

The user first needs to select an operation of the web service under test, and then the following table automatically displays the corresponding parameter information, including the names and types of the parameters of selected operation. Users need to divide each parameter into disjoint options according to the specification. There are two rules that users most follow: 1) the values of discrete options are represented by sets; 2) the values of successive options are represented by intervals.

Then user can parse wsdl, set parameters, partition input domain, generate test cases, and download test report in the following interfaces.



Specifying URL

Please enter the address of the web service under test

Address

Parse

Parameters Setting

Please select an operator:

Operation

Index	Parameter	Type	Options
		Empty	

Save

Partition Construction and Parameter Setting

Please input option combinations for partition construction and set parameters for DRT:

Partition	Option Combination	Test Profile	Adjusting Fac or
partition	choices	profile	value

+ Add — Delete

Save

Test Cases Preparation

Please select a method to generate a test suite:

[✓ Randomly Generate Test Suite]

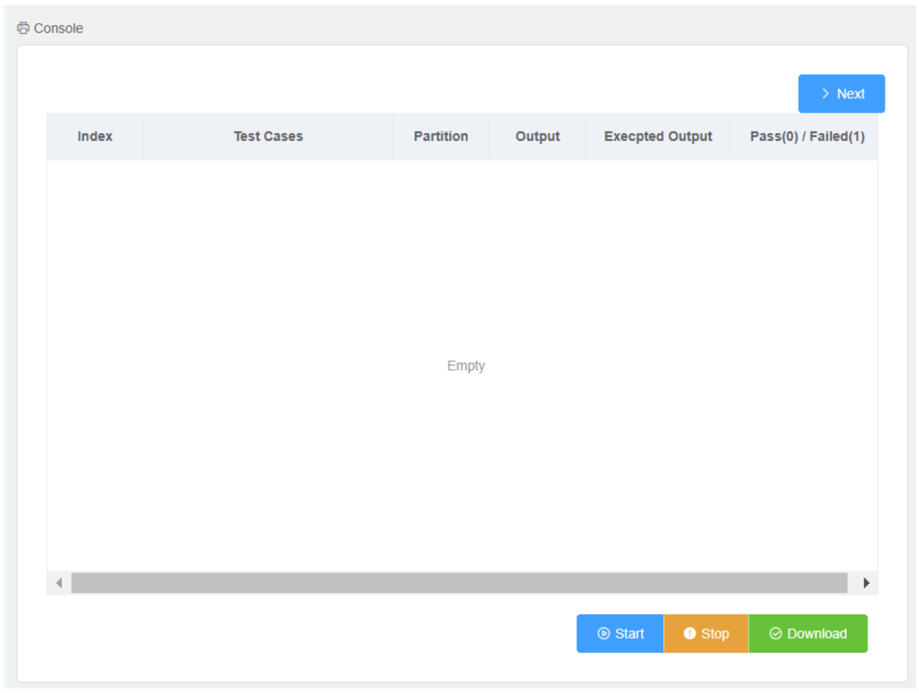
Upload Test Suite File

Please set the number of test cases to be generated: Numb

Generate

Please upload an XML file that contains test cases:

Upload



Index	Test Cases	Partition	Output	Execpted Output	Pass(0) / Failed(1)

WSDL parsing web service

In order to obtain the necessary to generate test cases and automatically invoke web service under test, we need to parse wsdl of web service under test. Accordingly, a web service has been developed to obtain all methods of web service under test, and their parameters information (name and type). Besides, we also made this web service publicly accessible (https://github.com/phantomDai/parseesdlws.git).

Before running this web service, the user needs to configure the following environment.

1. Tomcat 9.06

The default port of this web service is ***8085***. If changing the port of this web service, the user needs to change the the value of parameter *endpoint* in *ParseWSDL* script that can be available in linkage: https://github.com/phantomDai/drtAPI.git.

Micro services

The back-end logic is composed of several Restful APIs (For more details, please visit https://github.com/phantomDai/drtAPI.git) and Java classes: The APIs are responsible for communicating HTTP messages to and from the front-end interface. The controller class is responsible for updating the test profile according to the test results, and for selecting test cases from the partitions. The selected test cases are wrapped in SOAP messages and sent to the web service under test through the proxy class, which also intercepts the test results.

An example of testing web service

We show an example of testing web service using our prototype tool.

Environment

- Windows 10
- Tomcat 9.06
- JDK 1.8.0_161
- The address of the WSDL of web service under test: http://202.204.62.171:8081/services/acms?wsdl

The specification of web service under test

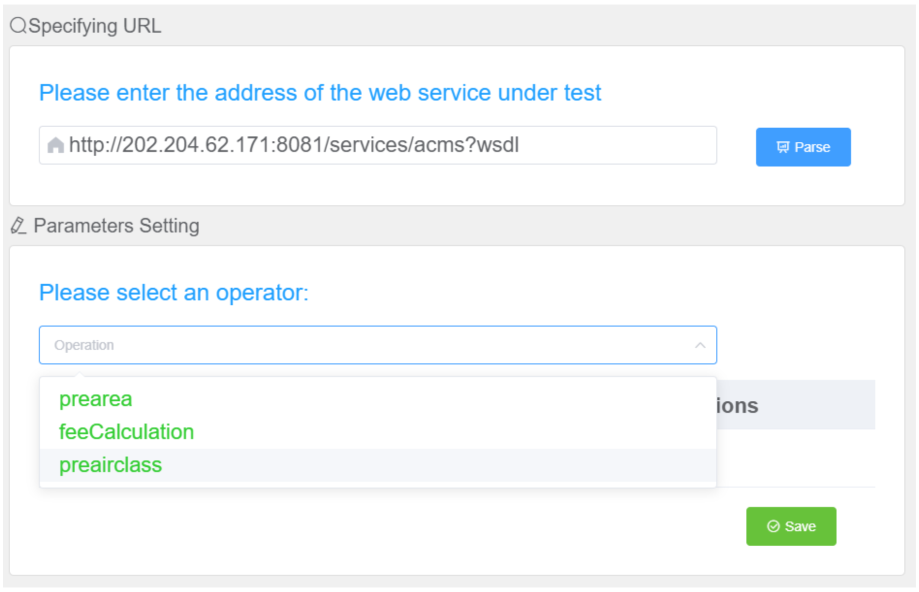
Aviation consignment management service (ACMS) helps airline companies check the allowance (weight) of free baggage, and the cost of additional baggage. Based on the destination, flights are categorised as either domestic or international. For international flights, the baggage allowance is greater if the passenger is a student (30kg), otherwise it is 20kg. Each aircraft offers three cabins classes from which to choose (economy, business, and first), with passengers in different classes having different allowances.

Testing steps

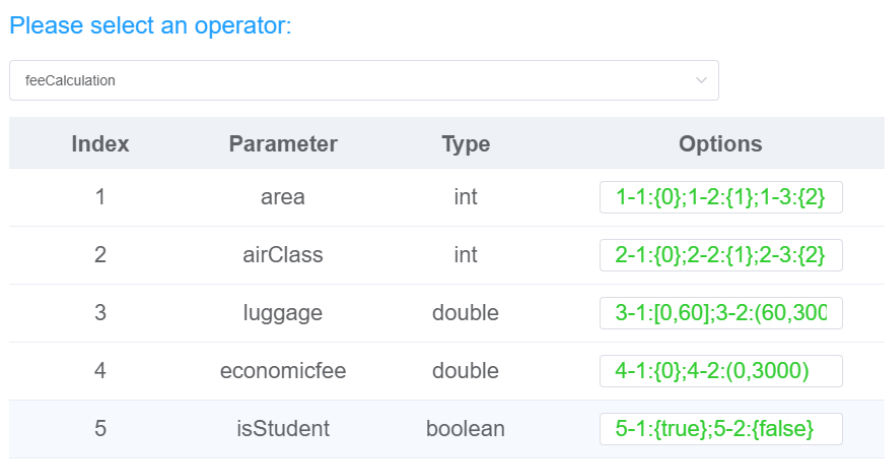
The details of testing steps are as follows.

Step 1: Specifying url and setting parameters

Users first need to enter the address of the WSDL of web service under test (WSUT), and click "Parse" button, and then a method of WSUT can be selected in the following drop-down menu (as shown in following figures).


Specifying URL
Please enter the address of the web service under test
http://202.204.62.171:8081/services/acms?wsdl
Parse
Parameters Setting
Please select an operator:
Operation
prearea
feeCalculation
preairclass
ions
Save

 Users must partition each parameter into disjoint options, and describe them according to predefined rules that are introduced in ***Guidance*** page (as shown in the following figure).

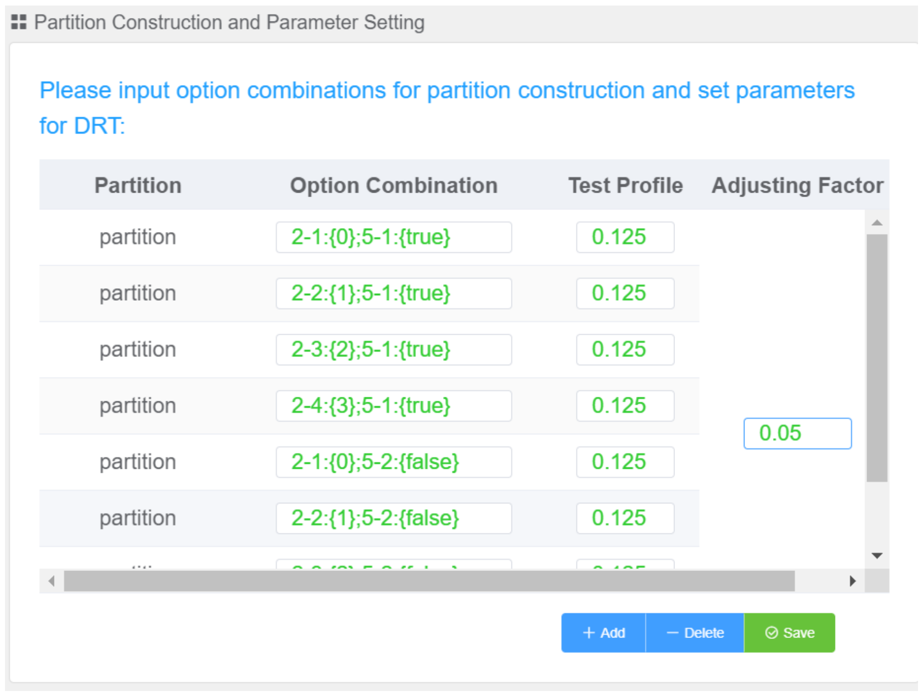

Please select an operator:

feeCalculation

Index	Parameter	Type	Options
1	area	int	1-1:{0};1-2:{1};1-3:{2}
2	airClass	int	2-1:{0};2-2:{1};2-3:{2}
3	luggage	double	3-1:[0,60];3-2:(60,300
4	economicfee	double	4-1:{0};4-2:(0,3000)
5	isStudent	boolean	5-1:{true};5-2:{false}

Step 2: Partition construction and parameter setting

Users must partition input domain by combining options with different parameters of selected method (as shown in following figure).


Partition Construction and Parameter Setting

Please input option combinations for partition construction and set parameters for DRT:

Partition	Option Combination	Test Profile	Adjusting Factor
partition	2-1:{0};5-1:{true}	0.125	0.05
partition	2-2:{1};5-1:{true}	0.125	
partition	2-3:{2};5-1:{true}	0.125	
partition	2-4:{3};5-1:{true}	0.125	
partition	2-1:{0};5-2:{false}	0.125	
partition	2-2:{1};5-2:{false}	0.125	

Step 3: Test case preparation

We provide two methods to generate test cases: 1) Randomly generate test cases; 2) Upload Json file that include test cases. Note that there are rules about the format of the uploaded Json file, which are described in ***Guidance*** page.