H2 Database Phase 2

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INTRODUCTION:

For implementing an enhanced feature for H2 Database in terms of data storage and indexing we have decided to implement a new data type called PhoneNumber. Phone number is an important piece of information which is present in almost every database. For our project, we are considering valid US phone numbers which follow the given constraints:

1. The phone number should have a length 10/12/13.

2. The user input should follow one of the following patterns:
2345678901
234-567-8901
(234)5678901
(234)567-8901

3. Then we compare this number with a list built with all the valid area codes as implemented by the North American Numbering Plan (NANP). It compares the first three digits from the user input and then compares it with the list entries and then returns if the number is a valid number or not. It also checks for the first digit of the number. If it is 0 or 1 then it is an invalid US number, otherwise it returns true.

IMPLEMENTATION:

H2 allows users to create their own data types by implementing the minimal required CustomDataTypesHandler API. To use this feature, the CustomPhoneDataTypeHandler.java file should implement all the abstract methods defined in the CustomDataTypesHandler interface.

The following changes have been made to the following files:

CustomPhoneDataTypeHandler.java - This class implements all the methods from the CustomDataTypesHandler interface.

ErrorCode.java - We added another unique custom error code for throwing exceptions when the user enters an invalid phone number by incrementing the last error code value in the original errorcode file.

```
/**
 * The error with code <code>90149</code> is thrown when trying to enter an invalid phone number
 */
public static final int INVALID_PHONE_NUMBER = 90150;
```

Phone.java - The main function that we created was the validatePhoneNumber function which takes the phone number from the user as a string and then checks if it is a valid number or not. We stored all the valid US area codes in a list of strings.

```
String[] areaCodes = {"201","202","203","204","205","206","207","208","209","210","212","213","214","215","216"
        "217","218","219","223","224","225","226","228","229","231","234","239","240","242","246","248","250",
        "251","252","253","254","256","260","262","264","267","268","269","270","276","281","284","289","301",
        "302","303","304","305","306","307","308","309","310","312","313","314","315","316","317","318","319",
        "320","321","323","325","330","334","336","337","339","340","345","347","351","352","360","361","386",
        "401","402","403","404","405","406","407","408","409","410","412","413","414","415","416","417","418",
        "419","423","424","425","430","432","434","435","438","440","441","443","450","456","469","473","478",
        "479","480","484","500","501","502","503","504","505","506","507","508","509","510","512","513","514",
        "515","516","517","518","519","520","530","540","541","551","559","561","562","563","567","570","571",
        "573","574","580","585","586","600","601","602","603","604","605","606","607","608","609","610","612",
        "613","614","615","616","617","618","619","620","623","626","630","631","636","641","646","647","649",
        "650","651","660","661","662","664","670","671","678","682","684","700","701","702","703","704","705",
        "706","707","708","709","710","712","713","714","715","716","717","718","719","720","724","727","731",
        "732","734","740","754","757","758","760","762","763","765","767","769","770","772","773","774","775",
        "778","780","781","784","785","786","787","800","801","802","803","804","805","806","807","808","809",
        "810","812","813","814","815","816","817","818","819","828","829","830","831","832","843","845","847",
        "848","850","856","857","858","859","860","862","863","864","865","866","867","868","869","870","876",
        "877","878","888","900","901","902","903","904","905","906","907","908","909","910","912","913","914",
        "915","916","917","918","919","920","925","928","931","936","937","939","940","941","947","949","951",
        "952","954","956","970","971","972","973","978","979","980","985","989"};
```

Along with this, we also used regex patterns to eliminate invalid numbers and restricted the valid inputs to the above mentioned patterns. Another condition that we added to this is that the first number can not be a 0 or 1.

SysProperties.java - The CustomPhoneDataTypeHandler class name that is used must be the same on client and server to work correctly. This function provides support for user defined custom data types. The initial value is set to null if there are no custom data types used.

```
public static final String CUSTOM_DATA_TYPES_HANDLER =
        Utils.getProperty("h2.customDataTypesHandler", "org.h2.api.CustomPhoneDataTypeHandler");
```

Value.java - This is the base class file which contains all the data types, it's conversion methods and comparison methods supported by the H2 database. For adding the custom data type Phone, the following code is used.

```
/**
 * The value type for PHONE values.
 */
public static final int PHONE = 42;

/**
 * The number of value types.
 */
public static final int TYPE_COUNT = PHONE + 1;
```

We modified the switch case for additional condition for Phone datatype.

```
case PHONE:
    return 53 000;
```

ValuePhone.java - This class overrides the methods from the Value class which is the base class for all data types.

_messages_en.prop - We added a line in the original error code file.
“90150=Invalid US phone number or phone number format “ to display the custom error message for invalid phone numbers.

DEMO:

1. Creating a table with custom Phone Number data type

Create a table STUDENT with attributes ID INT primary key, name VARCHAR(15) and phoneNumber PHONE.

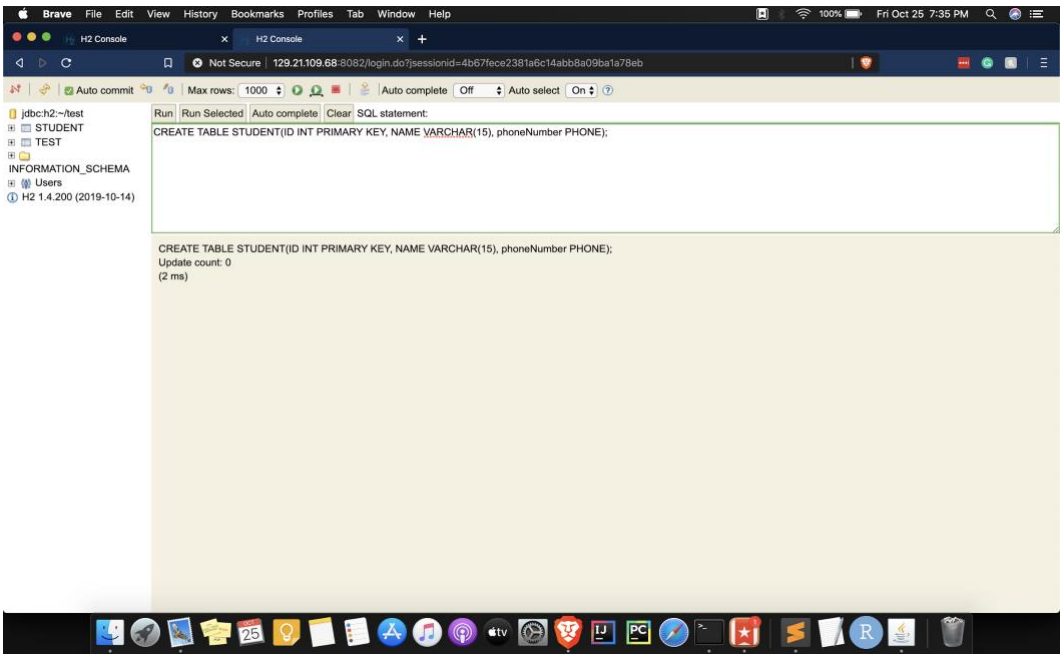
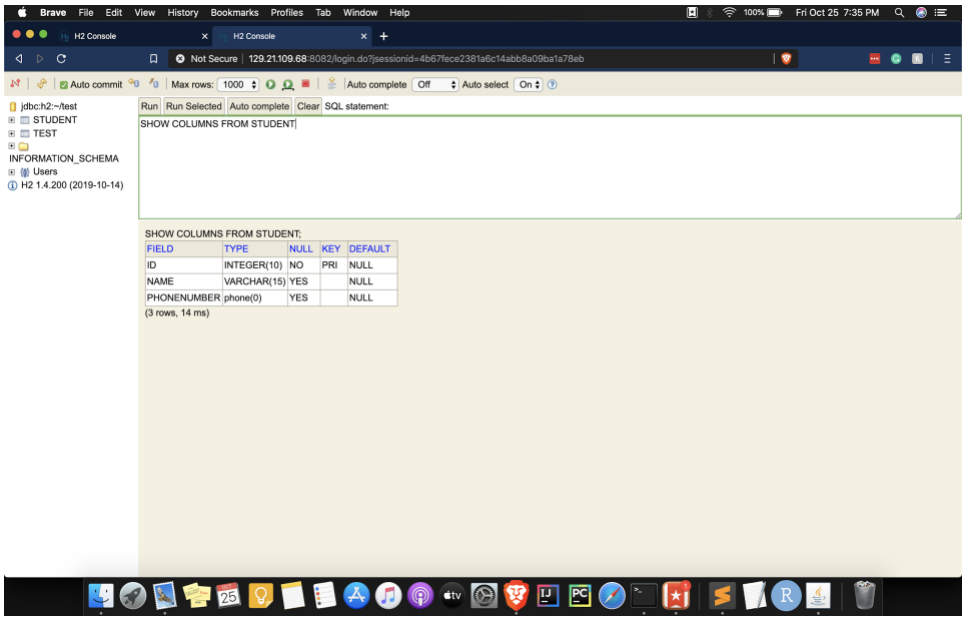
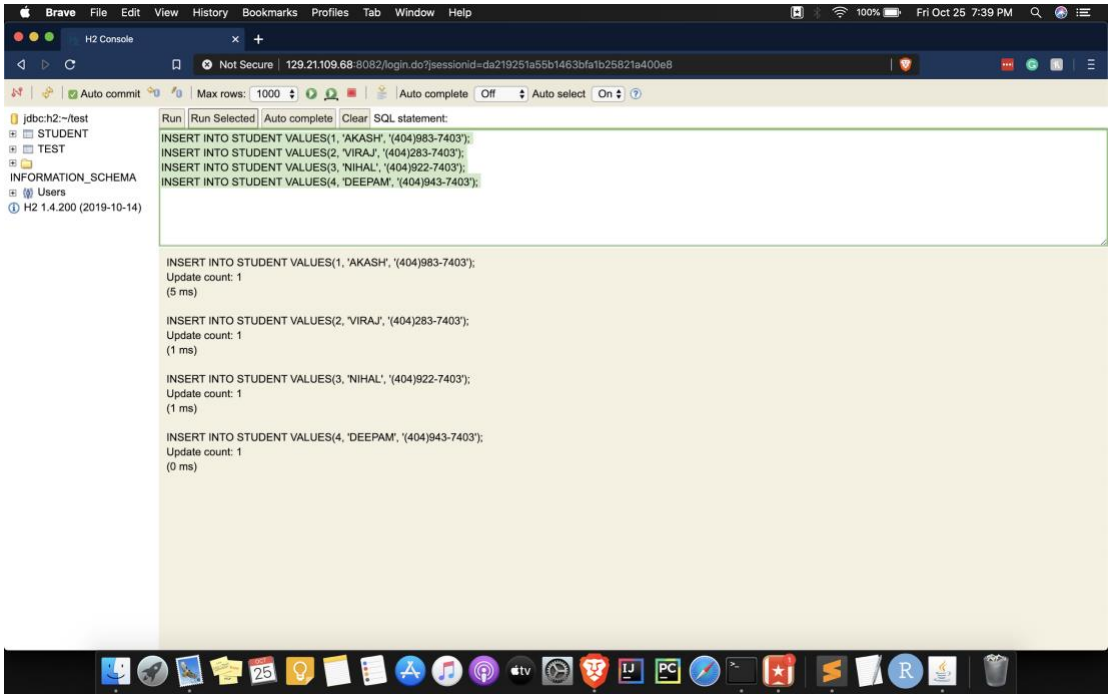


Table STUDENT is successfully created with attributes ID INT primary key, name VARCHAR(15) and phoneNumber PHONE.

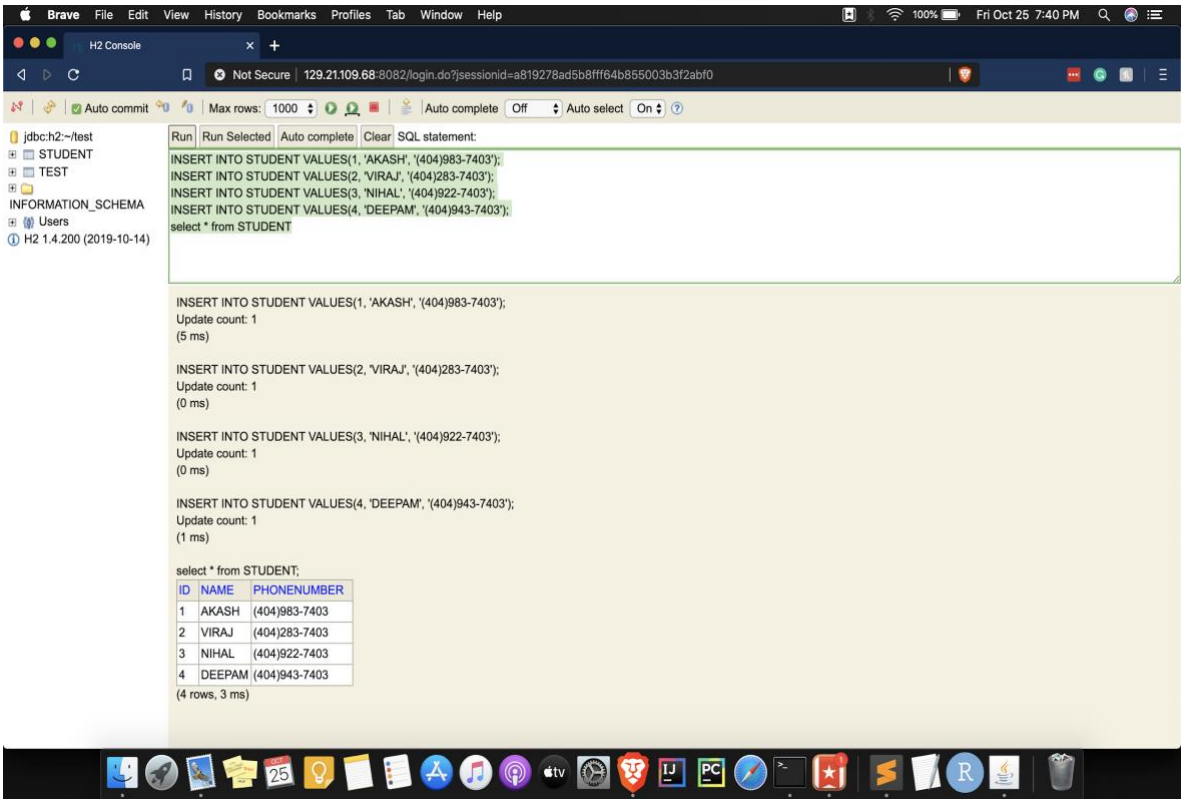
2. Displaying the column information for the created table



3. Inserting new records in the user info table

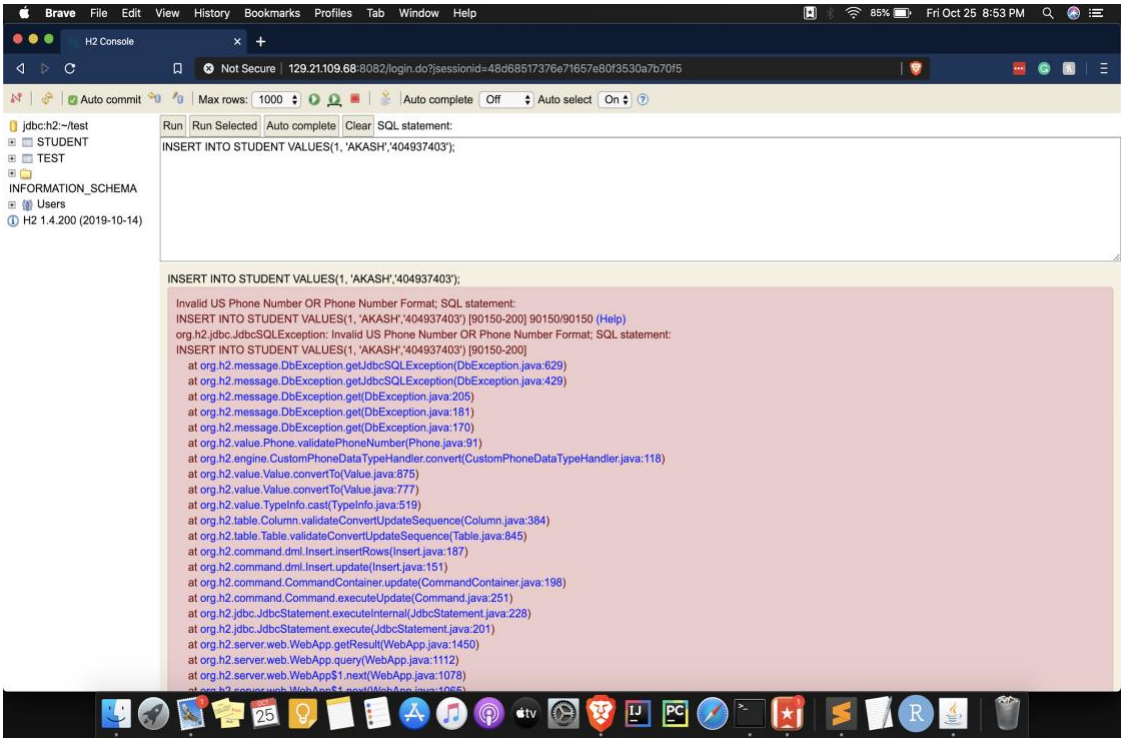


4. Displaying records of the user info table

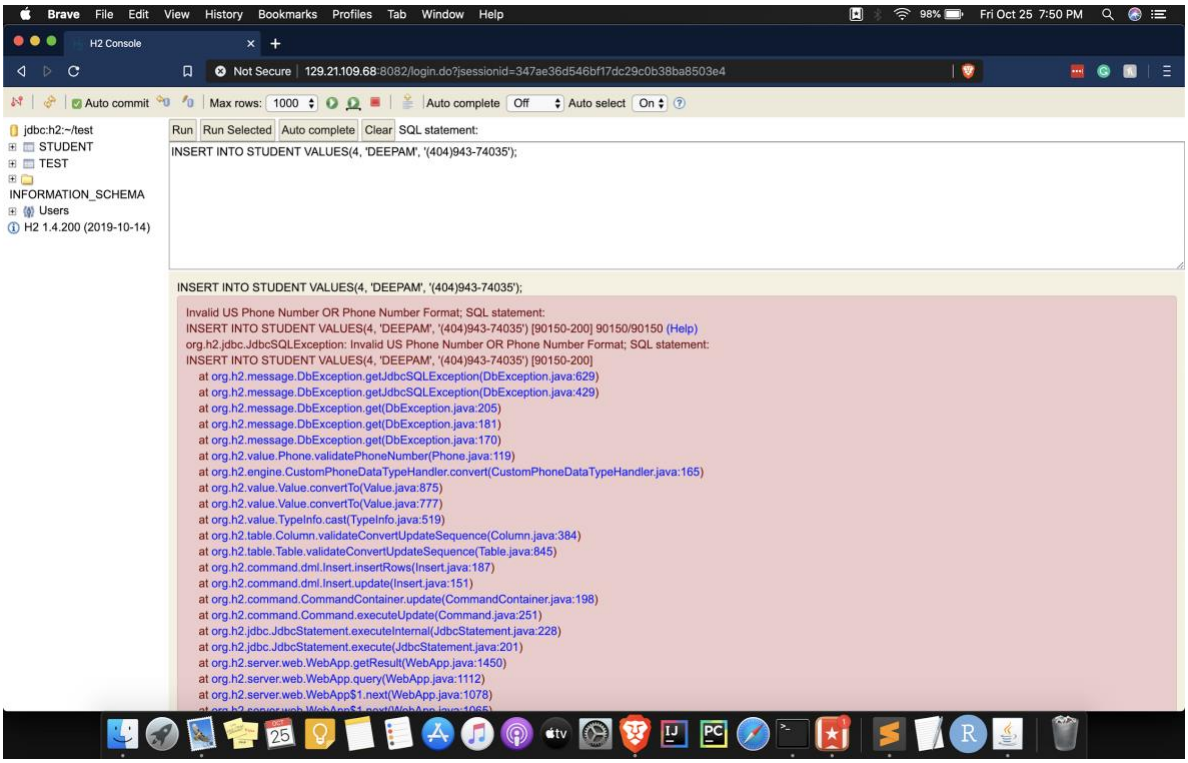


5. Some examples of invalid inputs

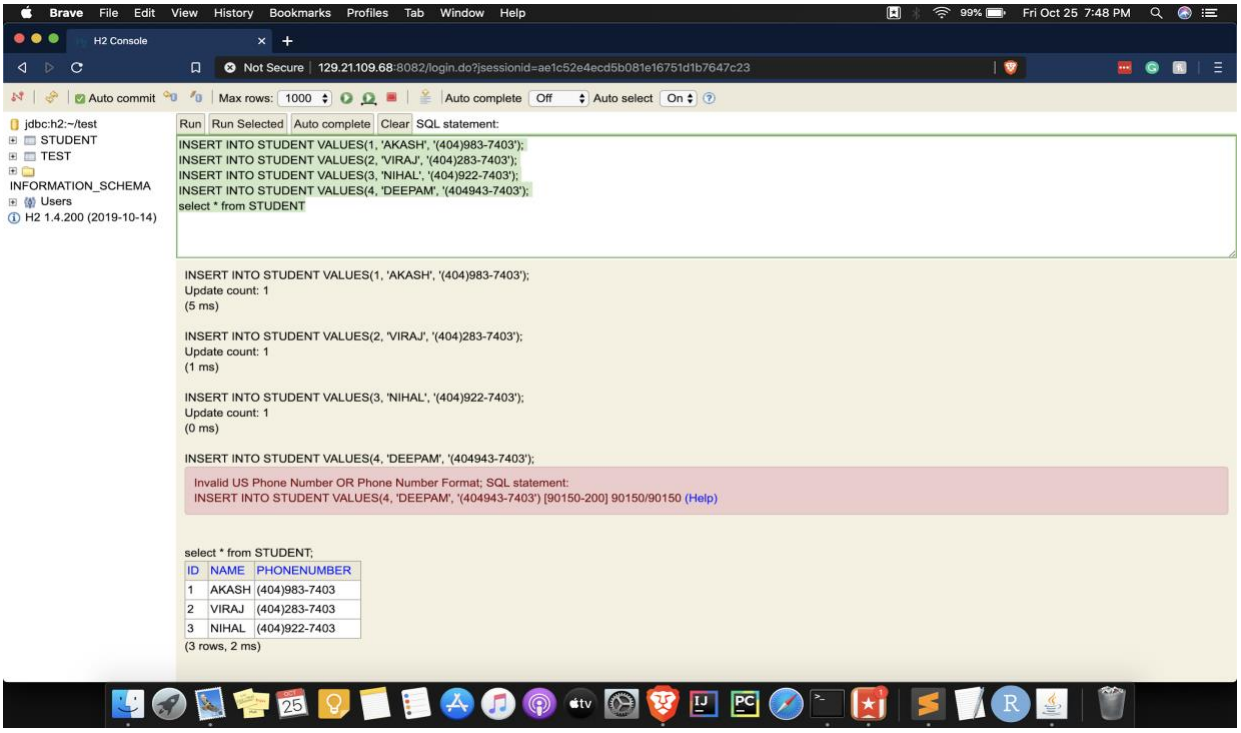
a. Input of length less than 10 [no separators used " (" , ") " , " - "]



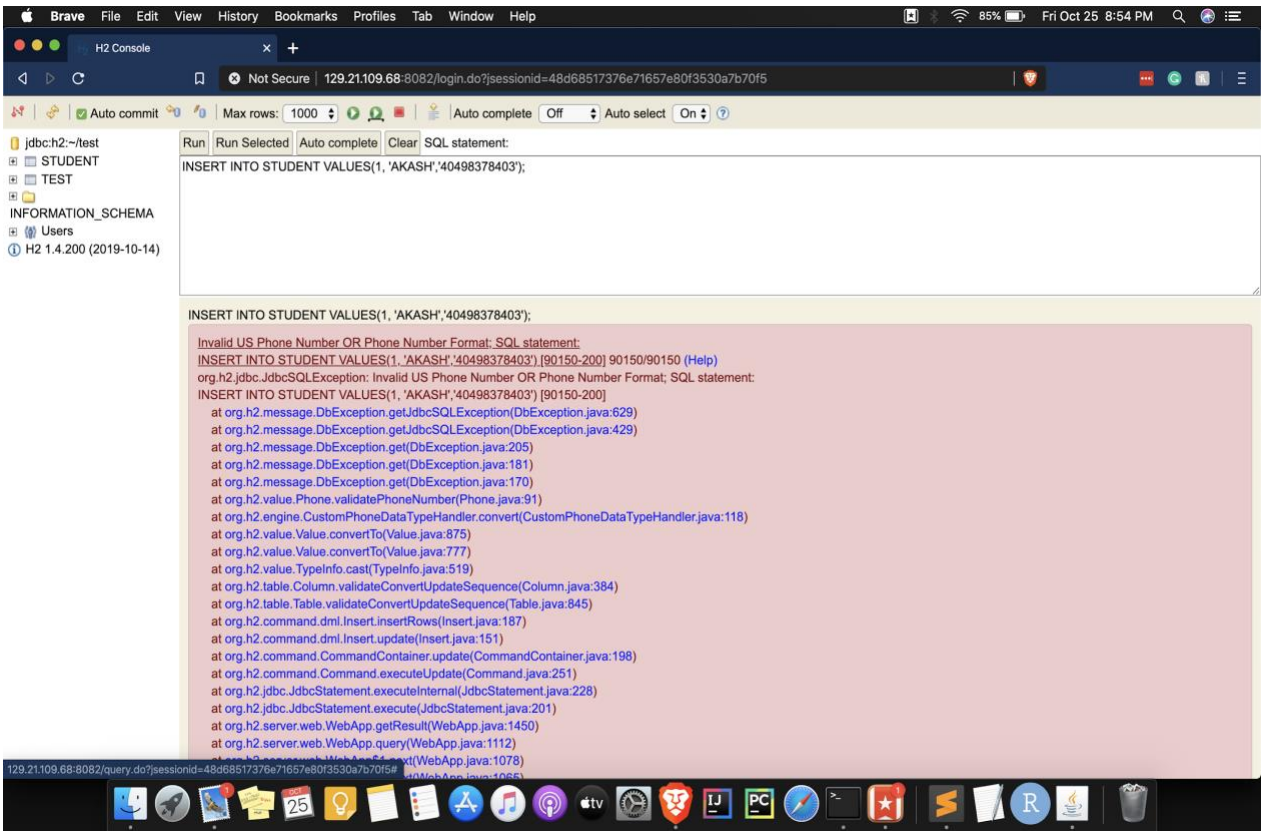
b. Input of length greater than 13 [separators used " (" , ") " , " - "]



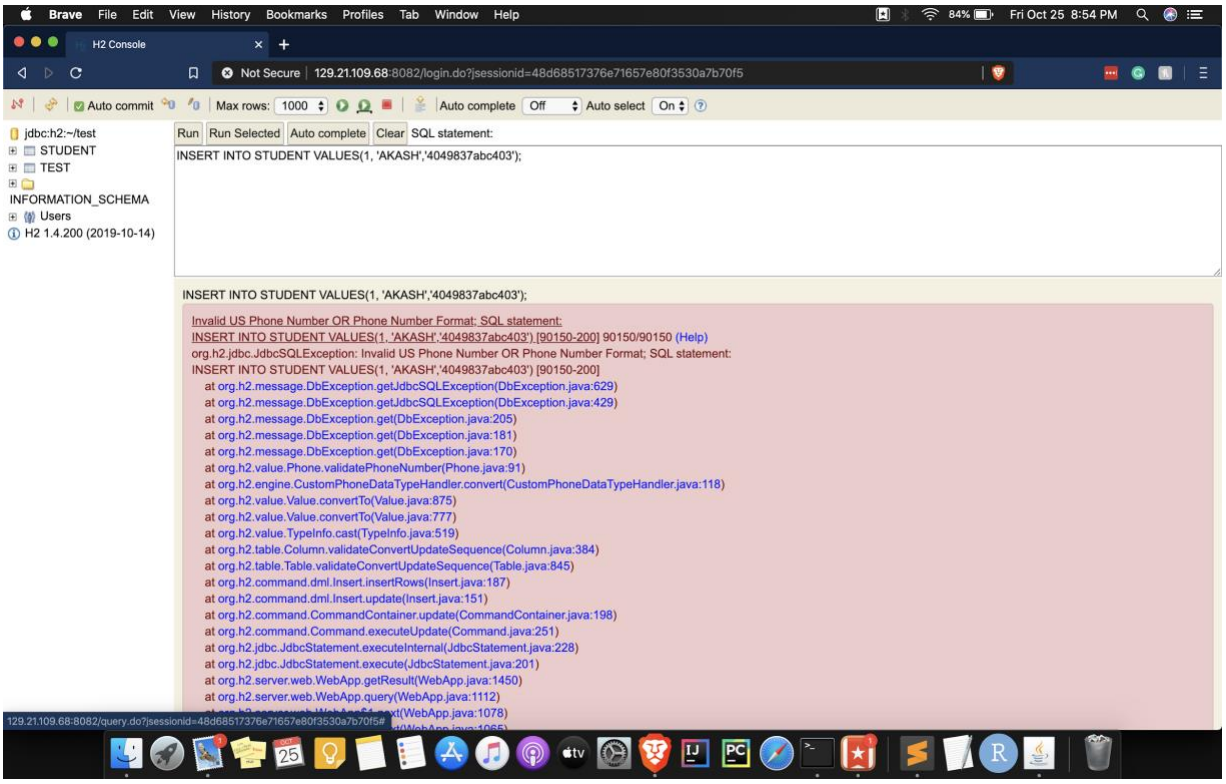
c. Also handles cases when inserting multiple records with valid and invalid records



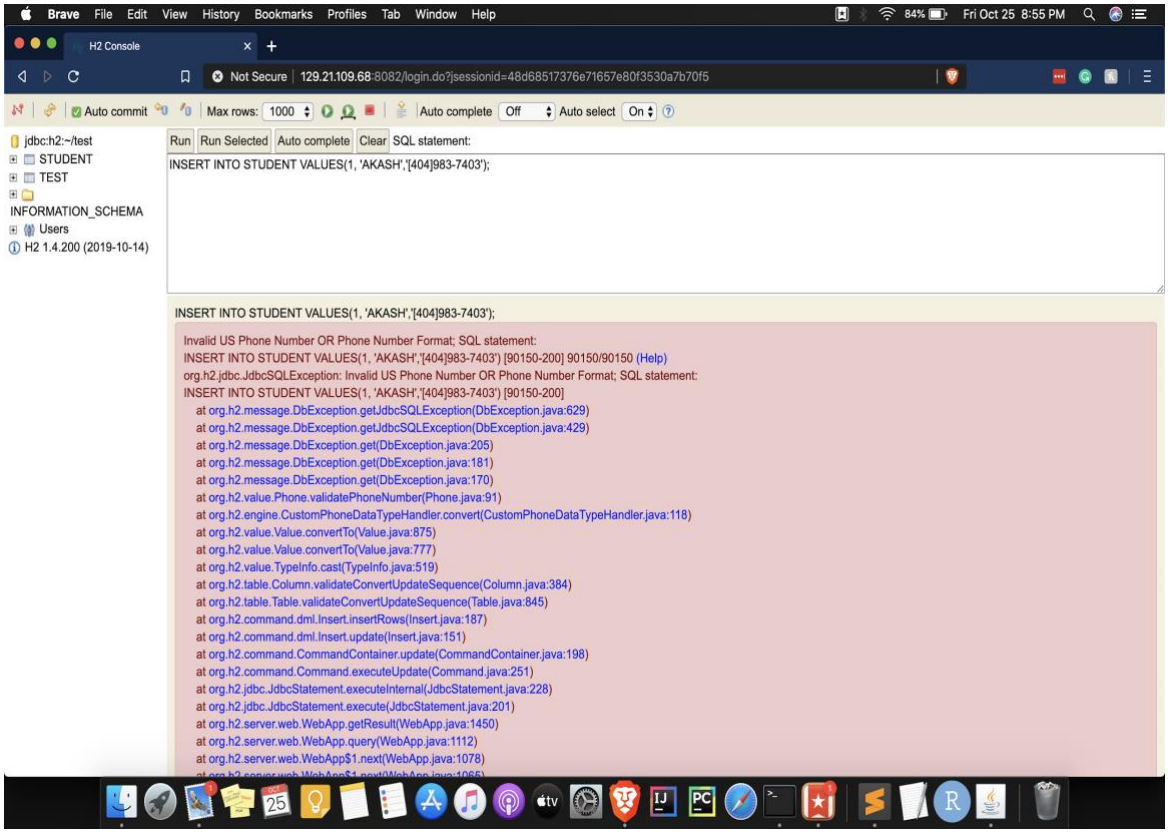
d. Input of length 11



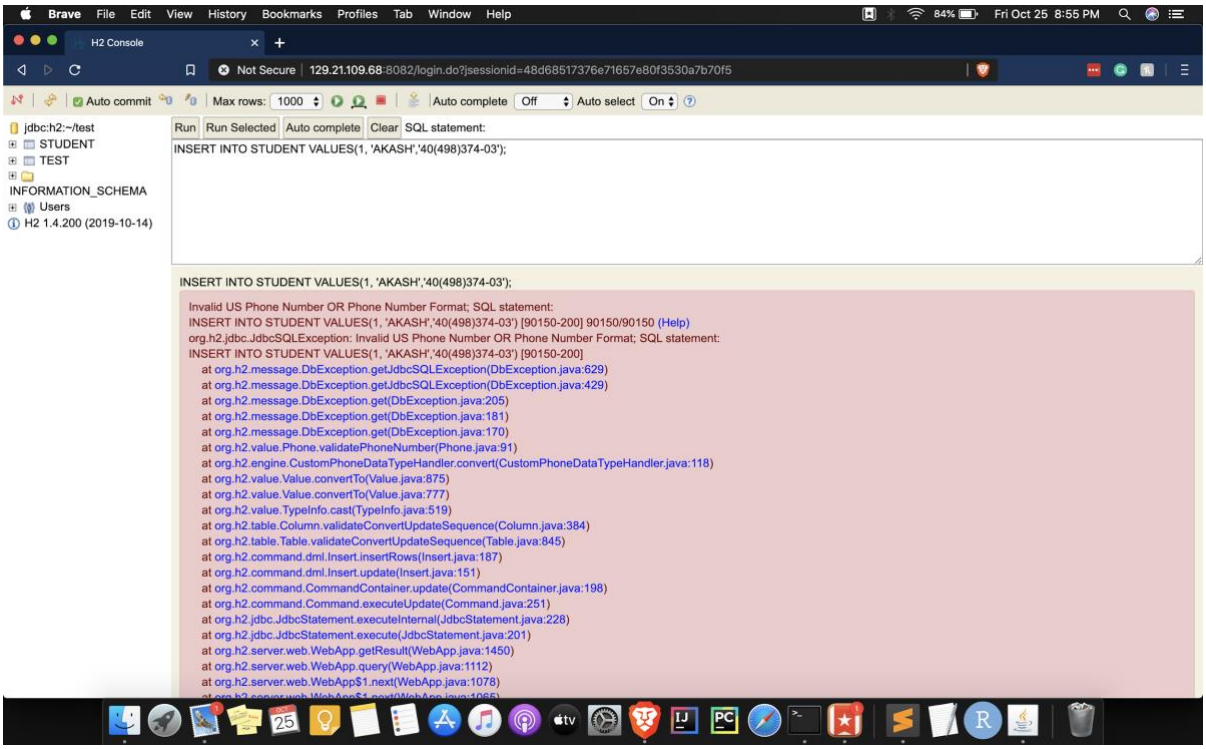
e. Input containing characters



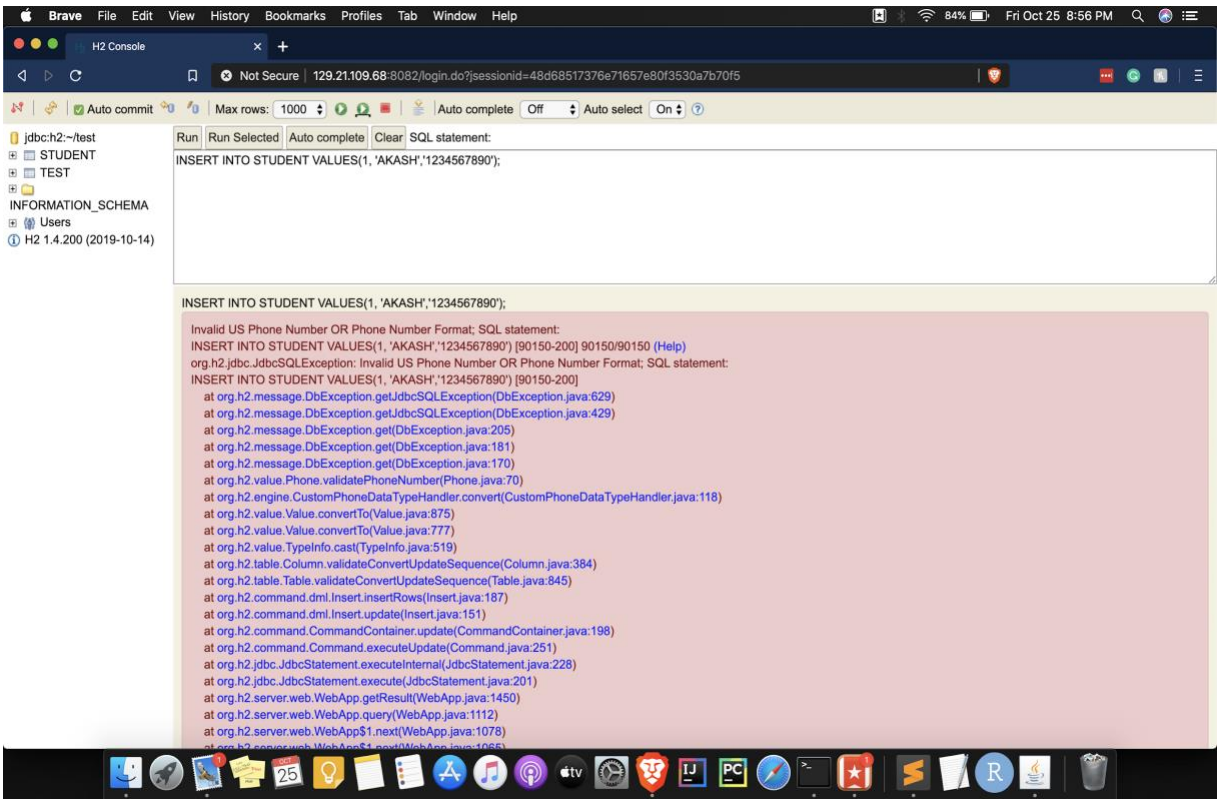
f. Input containing special characters except “ (“ , “) ” , “ - ”



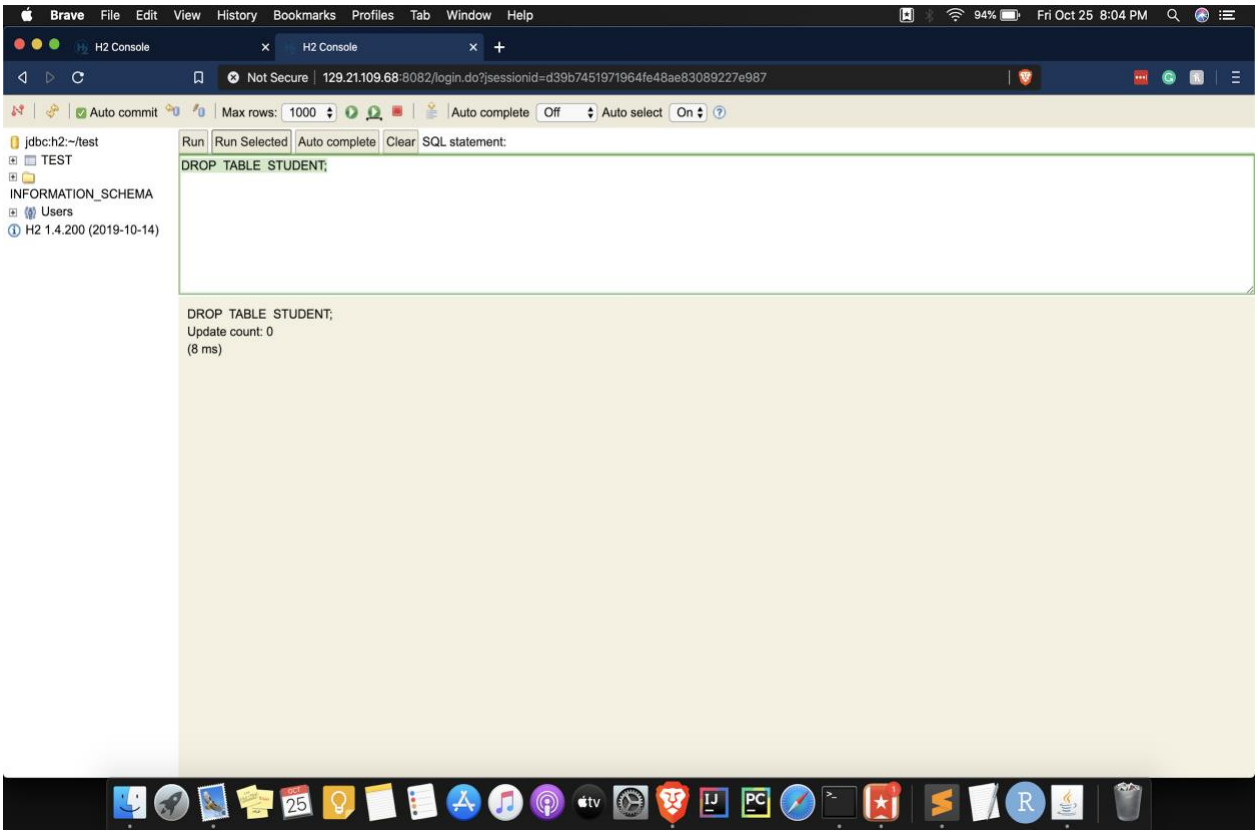
g. Input containing special characters “ (“ , “) ” , “ - ” at wrong places



h. First digit 1



6. Deleting entire table



REFERENCES:

1. https://github.com/h2database/h2database
2. http://www.h2database.com/html/advanced.html#custom_data_types_handler_api