CMPS 350 Web Development Fundamentals
Lab 6 –Object Oriented Programming and Unit Testing with JavaScript

Objective

The purpose of this laboratory exercise is to strengthen your skills in Object Oriented Programming in JavaScript. You will practice working with the following features:

- **Object literals**, which consist of a series of name-value pairs and associated functions enclosed in curly braces.
- **Classes**, which involve creating classes and utilizing them to create objects.
- **Inheritance**, which is the ability of a class to inherit properties and methods from a parent class.
- **Modules**, which allow for the exporting and importing of code between files.
- **Unit Testing**, which involves writing code to test the functionality of your program.

This Lab is divided into two parts:

- **PART A**: Banking App (duration: 1h20mins).
- **PART B:** Unit Testing

PART A – Banking App

In this exercise, you will build a simple banking app. The app will consist of several classes, each with its own set of properties and methods, that will simulate different types of bank accounts, such as saving accounts and current accounts. You will also create a Bank class that will manage all the accounts and perform various operations, such as adding, deleting, and retrieving accounts as shown in Figure 1.

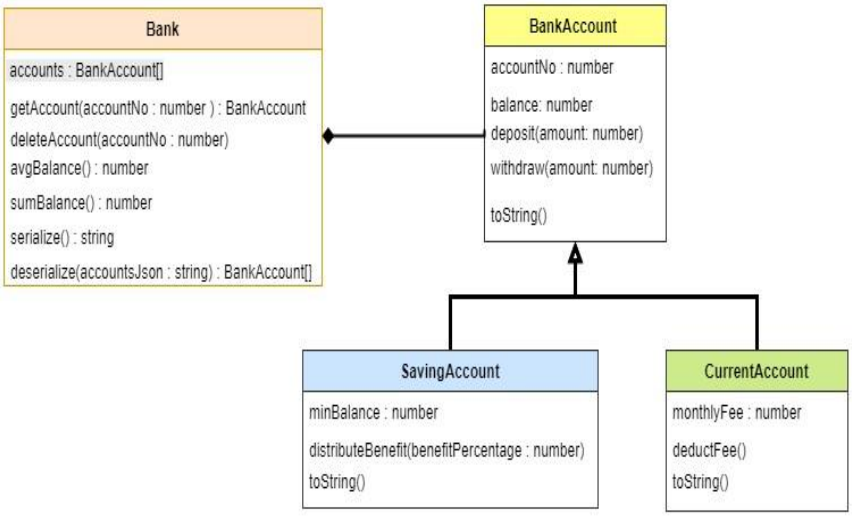


Figure 1. Banking App Class Diagram

1) Create a class called **BankAccount** with two private properties: **accountNo** and **balance**. The account number should be **randomly generated**, and the balance should be initialized through the constructor of the class. The class should also have the following method

   - getters for both accountNo and balance
   - deposit(amount): adds the amount to the balance
   - withdraw(amount): subtracts the amount from the balance
   - toString(): this method return Account # **accountNo** has QR **balance**. e.g., Account #123 has QR1000.

Export the **BankAccount** class as a module.

2) Create app.js program. Declare an array called accounts and initialize it with the following accounts:

accountNo	**balance**
123	1000
234	4000
345	3500

Display the content of the **accounts** array.

3) Create **SavingAccount** class that extends BankAccount with an extra property: minBalance and an extra method distributeBenefit(benefitPercentage). This method computes the monthly benefit using the balance += (balance * benefitPercentage). The constructor should extend BankAccount to initialize the minBalance. Also, extend the toString() to indicate that this is a Saving Account. e.g., e.g., **Saving** Account #123 has QR1000.

Test SavingAccount in app.js using the same table above and use a minimum balance of 500 for all accounts.

4) Create **CurrentAccount** class that extends BankAccount with an extra property: monthlyFee and an extra method deductFee(). This method subtracts the monthlyFee from the account balance. The constructor should extend BankAccount to initialize the monthlyFee. Also, extend the toString() to indicate that this is a Current Account. e.g., e.g., **Current** Account #123 has QR1000.

   Test **CurrentAccount** in app.js using the same table above and use a monthly fee of 10 for all accounts.

5) Create **Bank** class to manage accounts. It should have **accounts** property to store the accounts. Also, it should have the following methods:

Method	**Functionality**
add(account)	Add account (either Saving or Current) to accounts array.
getAccount(accountNo)	Return an account by account No
deleteAccount(accountNo)	Delete an account by account No

avgBalance()	Get the average balance for all accounts
sumBalance()	Get the sum balance for all accounts
toJson()	Return accounts as a JSON string
fromJson(accountsJson)	Takes JSON string representing accounts and returns an array of accounts.

6) Create app.js program. Declare an instance of Bank class then add the following accounts:

accountNo	**balance**	**type**	**minimumBalance**	**monthlyFee**
123	500	Saving	1000	
234	4000	Current		10
345	35000	Current		15
456	60000	Saving	1000	

- Test all the Bank methods described above.
- Display the total balance of all accounts.
- Increase by 5 the monthly fee of all the **Current** accounts then charge the monthly fee.
- Display the total balance of all accounts after charging the monthly fee.
- For all the **Saving** accounts distribute the benefit using a 5% benefit.
- Display the total balance of all accounts after distributing the benefits.

Part B – Unit Testing Using Mocha and Chai

Unit testing is an essential part of modern software development. It involves testing individual units of code to ensure that they function as expected and meet the requirements of the application. Unit tests help to catch bugs and errors early in the development process, reducing the likelihood of issues arising in production.

In this section, we will cover the basics of unit testing with Mocha and Chai. We will explore how to write and run tests, how to use the various test styles provided by Mocha, and how to write assertions using Chai.

1. Sync cmps350-lab repo to get the Lab files.
2. Copy ***Lab6-JS OOP*** folder from cmps350-lab repo to your repository.
3. Open ***Lab6- JS OOP \UnitConverter.js*** in VS Code. You should see a JavaScript file named *UnitConverter.js*. In this exercise, you will create a spec file to unit test the function of the *UnitConverter* class.
4. Create package.json file using **npm init**. This file is used to define dependencies by listing the npm packages used by the app.

   Refresh your project to see the **package.json** file.
5. Install mocha and chai using *node package manager* (npm):

   npm install mocha -d

   npm install chai -d

This will add 2 dev dependencies to package.json file.

6. Add the following inside package.json file.

```
"scripts": {
  "test": "mocha **/*.spec.js"
}
```

7. Create a JavaScript file named **UnitConverter.spec.js**
8. Import an instance the *UnitConverter* class to be tested and the *chai expect* package.

```
import unitConverter from './UnitConverter.js';
import {expect} from 'chai';
```

9. Write 2 test cases for each method of **UnitConverter** class.

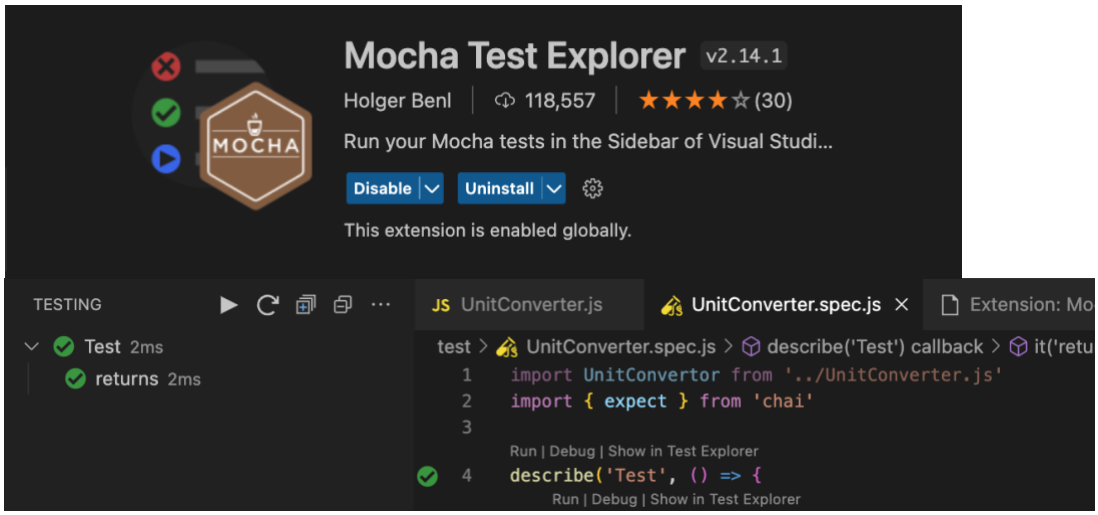
   You may start with the following inputs and expected results. Then use search for "google unit converter" to compute the expected results for more input values.

Method	Input	Expected Result
kgToOunce	1	35.274
kgToPound	2	4.4092
meterToInch	1	39.3701
meterToFoot	2	6.5617

Tips

- Use **expect** to make assertions about the output of the functions.
- Use **describe** and **it** functions to structure your tests.
- Use console.log statements to debug your tests if necessary.

10. Run the unit tests from the command line using: **npm test** –watch to automatically re-run them as you make changes.
11. You can also install the following extension.



Note : After you complete the lab, push your work to your GitHub repository.