Homework 3: Logic Coverage of Thermostat

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Contents

1 Setup

- 使用**Jest** 來測試JavaScript 程式，並滿足以下測試覆蓋準則：
  - PC（Predicate Coverage）
  - CC（Clause Coverage）
  - CACC（Correlated Active Clause Coverage）
- 檔案架構如下：

```
project/
├──── package.json
├──── Thermostat.js
├──── ProgrammedSettings.js
├──── __tests__/
│     └──── Thermostat.test.js
```

2 Complete and run the tests to satisfy PC

- PC（Predicate Coverage）要求每個條件表達式的**整體結果**至少為真一次、為假一次。
- 在Thermostat 中，核心謂詞如下：

```
C1 = (targetTemp - curTemp) > thresholdDiff
C2 = timeSinceLastRun >= minLag
Predicate: P = C1 && C2
```

- 測試T1 程式碼如下：

```
// C1 = True, C2 = True, P = True
test('T1: C1=true, C2=true → Heater ON (PC, CC, CACC)', () => {
  // curTemp
  thermostat.setCurrentTemp(60);

  // C1：(targetTemp - curTemp) > thresholdDiff == True
  thermostat.thresholdDiff = 5;

  // C2：timeSinceLastRun >= minLag == True
  thermostat.timeSinceLastRun = 5;
  thermostat.minLag = 3;

  const result = thermostat.turnHeaterOn(settings);
  expect(result.heaterOn).toBe(true);
  expect(result.runTime).toBe(10);
});
```

Figure 1: T1: C1 = True, C2 = True, P = True

- 測試T2 程式碼如下：

```
// C1 = False, C2 = True, P = False
test('T2: C1=false, C2=true → Heater OFF (PC, CC, CACC)', () => {
  thermostat.setCurrentTemp(71); // (70-71) > 5 == False
  thermostat.thresholdDiff = 5;
  thermostat.timeSinceLastRun = 5;
  thermostat.minLag = 3;

  const result = thermostat.turnHeaterOn(settings);
  expect(result.heaterOn).toBe(false);
  expect(result.runTime).toBe(0);
});
```

Figure 2: T2: C1 = False, C2 = True, P = False

3 Complete and run the tests to satisfy CC

- CC（Clause Coverage）要求每個子句獨立為true 和false 各至少一次。

Test	C1	C2	Predicate
T1	true	true	true
T2	false	true	false
T3	true	false	false

- 新增測試T3 程式碼如下：

```
// C1 = True, C2 = False, P = False
test('T3: C1=true, C2=false → Heater OFF (CC, CACC)', () => {
  thermostat.setCurrentTemp(60);
  thermostat.thresholdDiff = 5;
  thermostat.timeSinceLastRun = 2; // timeSinceLastRun >= minLag == False
  thermostat.minLag = 3;

  const result = thermostat.turnHeaterOn(settings);
  expect(result.heaterOn).toBe(false);
  expect(result.runTime).toBe(0);
});
```

Figure 3: T3: C1 = True, C2 = False, P = False

4 Complete and run the tests to satisfy CACC

- CACC（Correlated Active Clause Coverage）要求每個子句在能夠決定Predicate 結果的情況下，各取true、false 並觀察P 的改變。

以C1 為主子句：

Test	C1	C2	Predicate
T1	true	true	true
T2	false	true	false

以C2 為主子句：

Test	C1	C2	Predicate
T1	true	true	true
T3	true	false	false

藉由三個測試，便可完成Thermostat 中主要功能的CACC！

5 Advanced 1：Test Override Function to complete Thermostat Coverage Test

- 測試setOverride() 如下：

```
//Test Override mode
test('Override active → uses override temperature', () => {
  thermostat.setCurrentTemp(60);
  thermostat.setOverride(75);
  thermostat.thresholdDiff = 5;
  thermostat.timeSinceLastRun = 5;
  thermostat.minLag = 3;

  const result = thermostat.turnHeaterOn(settings);
  expect(result.heaterOn).toBe(true);     // 60 < 75 - 5 → true
});
```

Figure 4: Advanced 1: Test Override mode

- 測試clearOverride() 如下：

```
//Test Clear Override mode
test('clearOverride disables override mode', () => {
  thermostat.setOverride(75);
  expect(thermostat.override).toBe(true);
  thermostat.clearOverride();
  expect(thermostat.override).toBe(false);
});
```

Figure 5: Advanced 2: Test Clear Override mode

6 Advanced 2：Test ProgrammedSettings

- 測試getSetting() 如下：

```
//Test getSetting()
test('getSetting returns default 65 for invalid keys', () => {
  const settings = new ProgrammedSettings();
  expect(settings.getSetting('NOT_A_PERIOD', 'BAD_DAY')).toBe(65);
});
```

Figure 6: Test 1: Test getSetting returns default 65 for invalid keys

- 測試setSetting() 如下：

```
//Test setSetting()
test('setSetting does not crash on invalid keys', () => {
  const settings = new ProgrammedSettings();
  settings.setSetting('INVALID_PERIOD', 'INVALID_DAY', 100);
});
```

Figure 7: Test 2: Test setSetting does not crash on invalid keys

- 測試update value by setSetting() and getSetting() 如下：

```
//Test setSetting() & getSetting()
test('getSetting returns updated value', () => {
  const settings = new ProgrammedSettings();
  settings.setSetting(Period.EVENING, DayType.WEEKEND, 66);
  expect(settings.getSetting(Period.EVENING, DayType.WEEKEND)).toBe(66);
});
```

Figure 8: Test 3: Test getSetting returns updated value

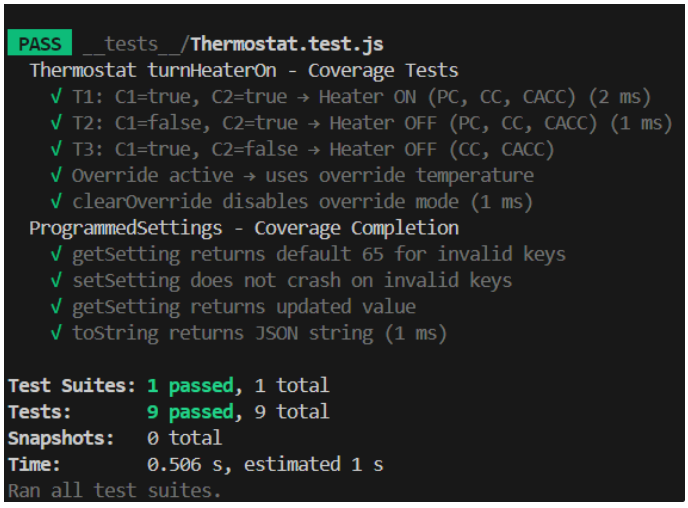
- 測試toString() 如下：

```
//Test toString()
test('toString returns JSON string', () => {
  const settings = new ProgrammedSettings();
  const json = settings.toString();
  expect(typeof json).toBe('string');
  expect(json).toContain('WEEKDAY');
});
```

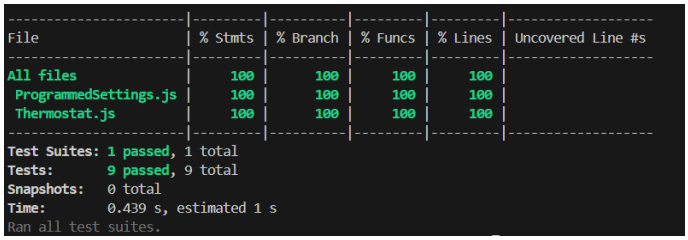
Figure 9: Test 4: Test toString returns JSON string

7 Test Result

- 執行：`npm test`
- 結果截圖如下：



- 執行：`npm run test:cov`
- 結果截圖如下：



8 Git Repository

GitHub Repo：`https://github.com/BrianGodd/113-spring-software-testing_hw3`