
School of Computing, Faculty of Engineering

SECJ2203: Software Engineering

# Problem Solving 3 (VV & T)

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Prepared for:

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**Problem Solving 3: Software Verification, Validation & Testing**

**INSTRUCTIONS:**

Ensure you write your team name, each team member's full name and matric number on the first page of your team submission. Only the team leader should submit the file by uploading via e-learning or as required by the course lecturer.

Teams who are caught copying other teams' work will be penalised by getting an 'F' grade for the concerned problem solving. This includes committing plagiarism by copying resources from the Internet without any citation or direct copy with citation, which should be quoted where applicable. Teams that allow their work to be copied will be penalised too.

Read the questions carefully and discuss them with your team members. Answer all questions within the given time. Your answers could be typed or written or as required by the lecturer.

**Question 1:** **[15 marks]**

Tenaga Nasional Berhad (TNB) is the Malaysian multinational electricity company and is the only electric utility company in Peninsular Malaysia. Due to the uncertain COVID-19 pandemic, TNB has developed a mobile application called myTNB to assist their customers to pay electricity bills online. Considering the "myBill" module is part of myTNB application, this module computes bill payment of electricity consumption for different users. Based on the electricity tariff category in the table below, write the test cases for testing the functionality of this module by using the **equivalence partitioning (EP)** strategy. State the representative input values based on the **boundary value analysis (BVA)** for each test case. Identify the range for each category based on the amount of electric energy consumed in kWh following the first and the second rates. The expected results should display the calculation and the total of the electricity bill in RM.

| Tariff Category | First Rate | Second Rate |
|---|---|---|
| Low Voltage Commercial | 40 cents for first 200 kWh | 50 cents for the following kWh |
| Low Voltage Industrial | 30 cents for first 200 kWh | 40 cents for the following kWh |

| | | |
|---|---|---|
| Domestic | 20 cents for first 200 kWh | 30 cents for the following kWh |

Write the solution using the table format as below.

| **Category** | **Equivalence Class** | **Status** | **Representative (BVA)** | **Expected Result** |
|---|---|---|---|---|
| **Low Voltage Commercial** | electricity rate < 1 kWh | Valid | 0 kWh | Bill = 0 * RM 0.40<br>= RM 0 |
| | 1 kWh ≤ electricity rate ≤ 200 kWh | Valid | 200 kWh | Bill = 200 kWh* RM 0.40<br>= RM 80 |
| | Electricity rate > 200 kWh | Valid | 201 kWh | Bill = 201 kWh* RM 0.50<br>= RM 100.50 |
| **Low Voltage Industrial** | electricity rate < 1 kWh | Valid | 0 kWh | Bill = 0 * RM 0.30<br>= RM 0 |
| | 1 kWh ≤ electricity rate ≤ 200 kWh | Valid | 200 kWh | Bill = 200 kWh* RM 0.30<br>= RM 60 |
| | Electricity rate > 200 kWh | Valid | 201 kWh | Bill = 201 kWh* RM 0.40<br>= RM 80.40 |
| **Domestic** | electricity rate < 1 kWh | Valid | 0 kWh | Bill = 0 * RM 0.20<br>= RM 0 |
| | 1 kWh ≤ electricity rate ≤ | Valid | 200 kWh | Bill = 200 kWh* RM 0.20 |

| | | | | |
|---|---|---|---|---|
| | 200 kWh | | | = RM 40 |
| | Electricity rate > 200 kWh | Valid | 201 kWh | Bill = 201 kWh* RM 0.50<br>= RM 100.50 |

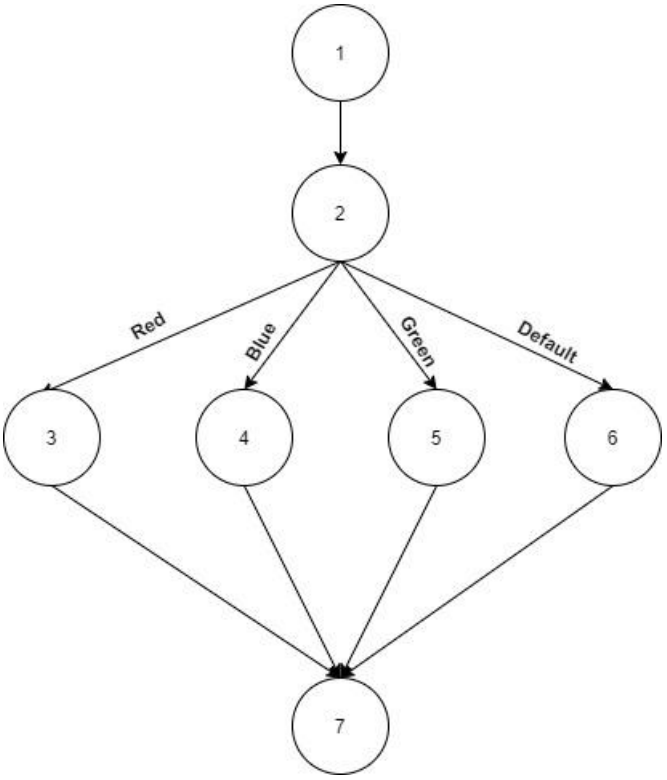
**Question 2:**

```
#include <iostream>
using namespace std;
int main() {
  int favColour = 0;
  cout << "State your favourite colour [1:red/2:blue/3:green/4:others]: ";
// Type a number and press enter
  cin >> favColour; // Get user input from the keyboard
    switch (favColour) {
        case 1:
            cout << "Your favourite colour is red!";
            break;
        case 2:
            cout << "Your favourite colour is blue!";
            break;
        case 3:
            cout << "Your favourite colour is green!";
            break;
        default:
            cout << "Your favourite colour is neither red, blue, nor green!";
  }
}
```

**[20 marks]**

Based on the source code above, answer the following questions:

a. Draw a **flow graph**.




b. Calculate the **cyclomatic complexity**.

1. V(G) = #Edges - #Nodes + 2

   = 9 – 7 + 2 = 4

2. V(G) = #Predicate Nodes + 1

   = 1 + 1 = 2

3. V(G) = #Region

   = 1

c. Identify and list down all **independent paths** based on the answer in (a).

1-2-3-7, 1-2-4-7, 1,-2-5-7, 1-2-6-7

d. Design a **test case** to force execution down each independent path. Use the table format as given below when designing the test cases.

| Independent Path | Data for Test Cases | Expected Result |
|---|---|---|
| 1-2-3-7 | favColour = 1 | Your favourite colour is red! |
| 1-2-4-7 | favColour = 2 | Your favourite colour is blue! |
| 1-2-5-7- | favColour = 3 | Your favourite colour is green! |
| 1-2-6-7 | favColour = 4 | Your favourite colour is neither red, blue, nor green! |

**Total: 35 marks (4%)**