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Department of Computer Science and Engineering

Course Code: CSE430

Course Title: Software Testing and Quality Assurance

Section: 02

Semester: Spring 25

**Assignment 01**

**Submitted to:**

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# **Question 1**

1. A program takes as input a numeric string (4–15 digits) and a single digit (0–9) and checks whether that single digit is present in the numeric string or not.

Design test cases using:

1. Boundary Value Checking (BVC)

2. Robust Testing

3. Worst-Case Testing

### **Solution**

**BVC:**

Test cases using **BVC** Since there are two inputs the total number of test cases will be 4𝑛+1 = 9. The set of boundary values is shown below:

|  |  |  |
| --- | --- | --- |
|  | **Numeric string** | **Single digit** |
| Min Value | 1234 | 0 |
| Min+ Value | 12345 | 1 |
| Max Value | 012345678912345 | 9 |
| Max- Value | 01234567891234 | 8 |
| Nominal Value | 123456789 | 5 |

Using these values, test cases can be designed as shown below:

|  |  |  |  |
| --- | --- | --- | --- |
| **Test id** | **Numeric string** | **Single digit** | **Expected Output** |
| 1 | 1234 | 5 | Not in String |
| 2 | 12345 | 5 | Present in String |
| 3 | 123456789012345 | 5 | Present in String |
| 4 | 12345678901234 | 5 | Present in String |
| 5 | 123456789 | 0 | Not in String |
| 6 | 123456789 | 1 | Present in String |
| 7 | 123456789 | 9 | Present in String |
| 8 | 123456789 | 8 | Present in String |
| 9 | 123456789 | 5 | Present in String |

**Robust Testing:**

Test cases using **Robust Testing** Since there are two inputs the total number of test cases will be 6𝑛+1 = 13. The set of boundary values is shown below:

|  |  |  |
| --- | --- | --- |
|  | **Numeric string** | **Single digit** |
| Min- Value | 123 | -1 |
| Min Value | 1234 | 0 |
| Min+ Value | 12345 | 1 |
| Max- Value | 12345678901234 | 8 |
| Max Value | 123456789012345 | 9 |
| Max+ Value | 1234567890123456 | 10 |
| Nominal Value | 123456789 | 5 |

Using these values, test cases can be designed as shown below:

|  |  |  |  |
| --- | --- | --- | --- |
| **Test id** | **Numeric string** | **Single digit** | **Expected Output** |
| 1 | 123 | 5 | Invalid Input |
| 2 | 1234 | 5 | Not in String |
| 3 | 12345 | 5 | Present in String |
| 4 | 12345678901234 | 5 | Present in String |
| 5 | 123456789012345 | 5 | Present in String |
| 6 | 1234567890123456 | 5 | Invalid Input |
| 7 | 123456789 | -1 | Invalid Input |
| 8 | 123456789 | 0 | Not in String |
| 9 | 123456789 | 1 | Present in String |
| 10 | 123456789 | 8 | Present in String |
| 11 | 123456789 | 9 | Present in String |
| 12 | 123456789 | 10 | Invalid Input |
| 13 | 123456789 | 5 | Present in String |

**Worst case testing:**

Test cases using **Worst case testing** Since there are two inputs the total number of test cases will be 5𝑛 = 25. The set of boundary values is shown below:

|  |  |  |
| --- | --- | --- |
|  | **Numeric string** | **Single digit** |
| Min Value | 1234 | 0 |
| Min+ Value | 12345 | 1 |
| Max Value | 123456789012345 | 9 |
| Max- Value | 12345678901234 | 8 |
| Nominal Value | 123456789 | 5 |

Using these values, test cases can be designed as shown below:

|  |  |  |  |
| --- | --- | --- | --- |
| **Test id** | **Numeric string** | **Single digit** | **Expected Output** |
| 1 | 1234 | 0 | Not in String |
| 2 | 1234 | 1 | Present in String |
| 3 | 1234 | 9 | Not in String |
| 4 | 1234 | 8 | Not in String |
| 5 | 1234 | 5 | Not in String |
| 6 | 12345 | 0 | Not in String |
| 7 | 12345 | 1 | Present in String |
| 8 | 12345 | 9 | Not in String |
| 9 | 12345 | 8 | Not in String |
| 10 | 12345 | 5 | Present in String |
| 11 | 123456789012345 | 0 | Present in String |
| 12 | 123456789012345 | 1 | Present in String |
| 13 | 123456789012345 | 9 | Present in String |
| 14 | 123456789012345 | 8 | Present in String |
| 15 | 123456789012345 | 5 | Present in String |
| 16 | 12345678901234 | 0 | Present in String |
| 17 | 12345678901234 | 1 | Present in String |
| 18 | 12345678901234 | 9 | Present in String |
| 19 | 12345678901234 | 8 | Present in String |
| 20 | 12345678901234 | 5 | Present in String |
| 21 | 123456789 | 0 | Not in String |
| 22 | 123456789 | 1 | Present in String |
| 23 | 123456789 | 9 | Present in String |
| 24 | 123456789 | 8 | Present in String |
| 25 | 123456789 | 5 | Present in String |

# **Question 2**

2. A program calculates the GCD of three numbers in the range [1, 50]. Design test cases for this program using BVC, robust testing, and worst-case testing methods.

### **Solution**

**BVC:**

Test cases using **BVC** Since there are three numbers a, b and c, the total number of test cases will be 4𝑛+1 = 13. The set of boundary values is shown below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **A** | **B** | **C** |
| Min Value | 1 | 1 | 1 |
| Min+ Value | 2 | 2 | 2 |
| Max Value | 50 | 50 | 50 |
| Max- Value | 49 | 49 | 49 |
| Nominal Value | 25 | 25 | 25 |

Using these values, test cases can be designed as shown below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test id** | **A** | **B** | **C** | **Expected Output** |
| 1 | 1 | 25 | 25 | 1 |
| 2 | 2 | 25 | 25 | 1 |
| 3 | 50 | 25 | 25 | 25 |
| 4 | 49 | 25 | 25 | 1 |
| 5 | 25 | 1 | 25 | 1 |
| 6 | 25 | 2 | 25 | 1 |
| 7 | 25 | 50 | 25 | 25 |
| 8 | 25 | 49 | 25 | 1 |
| 9 | 25 | 25 | 1 | 1 |
| 10 | 25 | 25 | 2 | 1 |
| 11 | 25 | 25 | 50 | 25 |
| 12 | 25 | 25 | 49 | 1 |
| 13 | 25 | 25 | 25 | 25 |

**Robust Testing:**

Test cases using **Robust Testing** Since there are three numbers a, b and c the total number of test cases will be 6𝑛+1 = 19. The set of boundary values is shown below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **A** | **B** | **C** |
| Min- Value | 0 | 0 | 0 |
| Min Value | 1 | 1 | 1 |
| Min+ Value | 2 | 2 | 2 |
| Max- Value | 49 | 49 | 49 |
| Max Value | 50 | 50 | 50 |
| Max+ Value | 51 | 51 | 51 |
| Nominal Value | 25 | 25 | 25 |

Using these values, test cases can be designed as shown below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test id** | **A** | **B** | **C** | **Expected Output** |
| 1 | 0 | 25 | 25 | Invalid Input |
| 2 | 1 | 25 | 25 | 1 |
| 3 | 2 | 25 | 25 | 1 |
| 4 | 49 | 25 | 25 | 1 |
| 5 | 50 | 25 | 25 | 25 |
| 6 | 51 | 25 | 25 | Invalid Input |
| 7 | 25 | 0 | 25 | Invalid Input |
| 8 | 25 | 1 | 25 | 1 |
| 9 | 25 | 2 | 25 | 1 |
| 10 | 25 | 49 | 25 | 1 |
| 11 | 25 | 50 | 25 | 25 |
| 12 | 25 | 51 | 25 | Invalid Input |
| 13 | 25 | 25 | 0 | Invalid Input |
| 14 | 25 | 25 | 1 | 1 |
| 15 | 25 | 25 | 2 | 1 |
| 16 | 25 | 25 | 49 | 1 |
| 17 | 25 | 25 | 50 | 25 |
| 18 | 25 | 25 | 51 | Invalid Input |
| 19 | 25 | 25 | 25 | 25 |

Test cases using **worst-case testing** Since there are three inputs the total number of test cases will be 5𝑛 = 125. The set of boundary values is shown below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **A** | **B** | **C** |
| Min Value | 1 | 1 | 1 |
| Min+ Value | 2 | 2 | 2 |
| Max Value | 50 | 50 | 50 |
| Max- Value | 49 | 49 | 49 |
| Nominal Value | 25 | 25 | 25 |

Using these values, test cases can be designed as shown below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test id** | **A** | **B** | **C** | **Expected Output** |
| 1 | 1 | 1 | 1 | 1 |
| 2 | 1 | 1 | 2 | 1 |
| 3 | 1 | 1 | 50 | 1 |
| 4 | 1 | 1 | 49 | 1 |
| 5 | 1 | 1 | 25 | 1 |
| 6 | 1 | 2 | 1 | 1 |
| 7 | 1 | 2 | 2 | 1 |
| 8 | 1 | 2 | 50 | 1 |
| 9 | 1 | 2 | 49 | 1 |
| 10 | 1 | 2 | 25 | 1 |
| 11 | 1 | 50 | 1 | 1 |
| 12 | 1 | 50 | 2 | 1 |
| 13 | 1 | 50 | 50 | 1 |
| 14 | 1 | 50 | 49 | 1 |
| 15 | 1 | 50 | 25 | 1 |
| 16 | 1 | 49 | 1 | 1 |
| 17 | 1 | 49 | 2 | 1 |
| 18 | 1 | 49 | 50 | 1 |
| 19 | 1 | 49 | 49 | 1 |
| 20 | 1 | 49 | 25 | 1 |
| 21 | 1 | 25 | 1 | 1 |
| 22 | 1 | 25 | 2 | 1 |
| 23 | 1 | 25 | 50 | 1 |
| 24 | 1 | 25 | 49 | 1 |
| 25 | 1 | 25 | 25 | 1 |
| 26 | 2 | 1 | 1 | 1 |
| 27 | 2 | 1 | 2 | 1 |
| 28 | 2 | 1 | 50 | 1 |
| 29 | 2 | 1 | 49 | 1 |
| 30 | 2 | 1 | 25 | 1 |
| 31 | 2 | 2 | 1 | 1 |
| 32 | 2 | 2 | 2 | 2 |
| 33 | 2 | 2 | 50 | 2 |
| 34 | 2 | 2 | 49 | 1 |
| 35 | 2 | 2 | 25 | 1 |
| 36 | 2 | 50 | 1 | 1 |
| 37 | 2 | 50 | 2 | 2 |
| 38 | 2 | 50 | 50 | 2 |
| 39 | 2 | 50 | 49 | 1 |
| 40 | 2 | 50 | 25 | 2 |
| 41 | 2 | 49 | 1 | 1 |
| 42 | 2 | 49 | 2 | 1 |
| 43 | 2 | 49 | 50 | 1 |
| 44 | 2 | 49 | 49 | 1 |
| 45 | 2 | 49 | 25 | 1 |
| 46 | 2 | 25 | 1 | 1 |
| 47 | 2 | 25 | 2 | 1 |
| 48 | 2 | 25 | 50 | 1 |
| 49 | 2 | 25 | 49 | 1 |
| 50 | 2 | 25 | 25 | 1 |
| 51 | 50 | 1 | 1 | 1 |
| 52 | 50 | 1 | 2 | 1 |
| 53 | 50 | 1 | 50 | 1 |
| 54 | 50 | 1 | 49 | 1 |
| 55 | 50 | 1 | 25 | 1 |
| 56 | 50 | 2 | 1 | 1 |
| 57 | 50 | 2 | 2 | 2 |
| 58 | 50 | 2 | 50 | 2 |
| 59 | 50 | 2 | 49 | 1 |
| 60 | 50 | 2 | 25 | 1 |
| 61 | 50 | 50 | 1 | 1 |
| 62 | 50 | 50 | 2 | 2 |
| 63 | 50 | 50 | 50 | 50 |
| 64 | 50 | 50 | 49 | 1 |
| 65 | 50 | 50 | 25 | 25 |
| 66 | 50 | 49 | 1 | 1 |
| 67 | 50 | 49 | 2 | 1 |
| 68 | 50 | 49 | 50 | 1 |
| 69 | 50 | 49 | 49 | 1 |
| 70 | 50 | 49 | 25 | 1 |
| 71 | 50 | 25 | 1 | 1 |
| 72 | 50 | 25 | 2 | 1 |
| 73 | 50 | 25 | 50 | 25 |
| 74 | 50 | 25 | 49 | 1 |
| 75 | 50 | 25 | 25 | 25 |
| 76 | 49 | 1 | 1 | 1 |
| 77 | 49 | 1 | 2 | 1 |
| 78 | 49 | 1 | 50 | 1 |
| 79 | 49 | 1 | 49 | 1 |
| 80 | 49 | 1 | 25 | 1 |
| 81 | 49 | 2 | 1 | 1 |
| 82 | 49 | 2 | 2 | 1 |
| 83 | 49 | 2 | 50 | 1 |
| 84 | 49 | 2 | 49 | 1 |
| 85 | 49 | 2 | 25 | 1 |
| 86 | 49 | 50 | 1 | 1 |
| 87 | 49 | 50 | 2 | 1 |
| 88 | 49 | 50 | 50 | 1 |
| 89 | 49 | 50 | 49 | 1 |
| 90 | 49 | 50 | 25 | 1 |
| 91 | 49 | 49 | 1 | 1 |
| 92 | 49 | 49 | 2 | 1 |
| 93 | 49 | 49 | 50 | 1 |
| 94 | 49 | 49 | 49 | 49 |
| 95 | 49 | 49 | 25 | 1 |
| 96 | 49 | 25 | 1 | 1 |
| 97 | 49 | 25 | 2 | 1 |
| 98 | 49 | 25 | 50 | 1 |
| 99 | 49 | 25 | 49 | 1 |
| 100 | 49 | 25 | 25 | 1 |
| 101 | 25 | 1 | 1 | 1 |
| 102 | 25 | 1 | 2 | 1 |
| 103 | 25 | 1 | 50 | 1 |
| 104 | 25 | 1 | 49 | 1 |
| 105 | 25 | 1 | 25 | 1 |
| 106 | 25 | 2 | 1 | 1 |
| 107 | 25 | 2 | 2 | 1 |
| 108 | 25 | 2 | 50 | 1 |
| 109 | 25 | 2 | 49 | 1 |
| 110 | 25 | 2 | 25 | 1 |
| 111 | 25 | 50 | 1 | 1 |
| 112 | 25 | 50 | 2 | 1 |
| 113 | 25 | 50 | 50 | 25 |
| 114 | 25 | 50 | 49 | 1 |
| 115 | 25 | 50 | 25 | 25 |
| 116 | 25 | 49 | 1 | 1 |
| 117 | 25 | 49 | 2 | 1 |
| 118 | 25 | 49 | 50 | 1 |
| 119 | 25 | 49 | 49 | 1 |
| 120 | 25 | 49 | 25 | 1 |
| 121 | 25 | 25 | 1 | 1 |
| 122 | 25 | 25 | 2 | 1 |
| 123 | 25 | 25 | 50 | 25 |
| 124 | 25 | 25 | 49 | 1 |
| 125 | 25 | 25 | 25 | 25 |

# 

# **Question 3**

3. A program reads employee records with the following details and prints a department-wise list containing employee name and their salary:

Employee Name (max. 30 characters)

Department Name (max. 20 characters)

Salary (in BDT, positive value)

The program groups employees by department and displays their names along with them salaries.

Design test cases for this program using BVC, robust testing, and worst-case testing methods.

### **Solution**

**BVC**

Test cases using **BVC** Since there are three variable departments, employee name and salary, the total number of test cases will be 4𝑛+1= 13. The set of boundary values is shown below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Employee name** | **Department** | **Salary** |
| Min Value | a | C | 10000 |
| Min+ Value | ab | CA | 10001 |
| Max Value | abcdefghijklmnopqrstuvwxyzabcd | Chartered Accounting | 50000 |
| Max- Value | abcdefghijklmnopqrstuvwxyzabc | Chartered Accounting | 49999 |
| Nominal Value | B. M. Shahria Alam | Information | 25000 |

Using these values, test cases can be designed as shown below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test id** | **Employee name** | **Department** | **Salary** | **Esxpected Output** |
| 1 | a | Information | 25000 | a, Information,25000 |
| 2 | ab | Information | 25000 | ab, Information, 25000 |
| 3 | abcdefghijklmnopqrstuvwxyzabcd | Information | 25000 | abcdefghijklmnopqrstuvwxyzabcd, Information, 25000 |
| 4 | abcdefghijklmnopqrstuvwxyzabc | Information | 25000 | abcdefghijklmnopqrstuvwxyzabc, Information, 25000 |
| 5 | B. M. Shahria Alam | C | 25000 | B. M. Shahria Alam, C, 25000 |
| 6 | B. M. Shahria Alam | CA | 25000 | B. M. Shahria Alam, CA, 25000 |
| 7 | B. M. Shahria Alam | Chartered Accounting | 25000 | B. M. Shahria Alam, Chartered Accounting, 25000 |
| 8 | B. M. Shahria Alam | Chartered Accounting | 25000 | B. M. Shahria Alam, Chartered Accounting, 25000 |
| 9 | B. M. Shahria Alam | Information | 10000 | B. M. Shahria Alam, Information, 10000 |
| 10 | B. M. Shahria Alam | Information | 10001 | B. M. Shahria Alam, Information, 10001 |
| 11 | B. M. Shahria Alam | Information | 50000 | B. M. Shahria Alam, Information, 50000 |
| 12 | B. M. Shahria Alam | Information | 49999 | B. M. Shahria Alam, Information, 49999 |
| 13 | B. M. Shahria Alam | Information | 25000 | B. M. Shahria Alam, Information, 25000 |

**Robust Testing:**

Test cases using **Robust Testing** Since there are three variable departments, employee name and salary. the total number of test cases will be 6𝑛+1 = 19. The set of boundary values is shown below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Employee name** | **Department** | **Salary** |
| Min- Value | (Empty) | (Empty) | -9999 |
| Min Value | a | C | 10000 |
| Min+ Value | ab | CA | 10001 |
| Max- Value | abcdefghijklmnopqrstuvwxyzabc | Chartered Accounting | 49999 |
| Max Value | abcdefghijklmnopqrstuvwxyzabcd | Chartered Accounting | 50000 |
| Max+ Value | abcdefghijklmnopqrstuvwxyzabcde | Chartered Accountings | 0 |
| Nominal Value | B. M. Shahria Alam | Information | 25000 |

Using these values, test cases can be designed as shown below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test id** | **Employee name** | **Department** | **Salary** | **Expected Output** |
| 1 | (Empty) | Information | 25000 | Invalid Input |
| 2 | a | Information | 25000 | a, Information, 25000 |
| 3 | ab | Information | 25000 | ab, Information, 25000 |
| 4 | abcdefghijklmnopqrstuvwxyzabcd | Information | 25000 | abcdefghijklmnopqrstuvwxyzabcd, Information, 25000 |
| 5 | abcdefghijklmnopqrstuvwxyzabc | Information | 25000 | abcdefghijklmnopqrstuvwxyzabc, Information, 25000 |
| 6 | abcdefghijklmnopqrstuvwxyzabcde | Information | 25000 | Invalid Input |
| 7 | B. M. Shahria Alam | (Empty) | 25000 | Invalid Input |
| 8 | B. M. Shahria Alam | C | 25000 | B. M. Shahria Alam, C, 25000 |
| 9 | B. M. Shahria Alam | CA | 25000 | B. M. Shahria Alam, CA, 25000 |
| 10 | B. M. Shahria Alam | Chartered Accounting | 25000 | B. M. Shahria Alam, Chartered Accounting, 25000 |
| 11 | B. M. Shahria Alam | Chartered Accounting | 25000 | B. M. Shahria Alam, Chartered Accounting, 25000 |
| 12 | B. M. Shahria Alam | Chartered Accountings | 25000 | Invalid Input |
| 13 | B. M. Shahria Alam | Information | -9999 | Invalid Input |
| 14 | B. M. Shahria Alam | Information | 10000 | B. M. Shahria Alam, Information,10000 |
| 15 | B. M. Shahria Alam | Information | 10001 | B. M. Shahria Alam, Information, 10001 |
| 16 | B. M. Shahria Alam | Information | 50000 | B. M. Shahria Alam, Information, 50000 |
| 17 | B. M. Shahria Alam | Information | 49999 | B. M. Shahria Alam, Information, 49999 |
| 18 | B. M. Shahria Alam | Information | 0 | Invalid Input |
| 19 | B. M. Shahria Alam | Information | 25000 | B. M. Shahria Alam, Information, 25000 |

**Worst-case testing**

Test cases using **worst-case testing** Since there are three inputs the total number of test cases will be 5𝑛 = 125. The set of boundary values is shown below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Employee name** | **Department** | **Salary** |
| Min Value | a | C | 10000 |
| Min+ Value | ab | CA | 10001 |
| Max Value | abcdefghijklmnopqrstuvwxyzabcd | Chartered Accounting | 50000 |
| Max- Value | abcdefghijklmnopqrstuvwxyzabc | Chartered Accounting | 49999 |
| Nominal Value | B. M. Shahria Alam | Information | 25000 |

Using these values, test cases can be designed as shown below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test id** | **Employee name** | **Department** | **Salary** | **Expected Output** |
| 1 | a | C | 10000 | a, C, 10000 |
| 2 | a | C | 10001 | a, C, 10001 |
| 3 | a | C | 50000 | a, C, 50000 |
| 4 | a | C | 49999 | a, C, 49999 |
| 5 | a | C | 25000 | a, C, 25000 |
| 6 | a | CA | 10000 | a, CA, 10000 |
| 7 | a | CA | 10001 | a, CA, 10001 |
| 8 | a | CA | 50000 | a, CA, 50000 |
| 9 | a | CA | 49999 | a, CA, 49999 |
| 10 | a | CA | 25000 | a, CA, 25000 |
| 11 | a | Chartered Accounting | 10000 | a, Chartered Accounting, 10000 |
| 12 | a | Chartered Accounting | 10001 | a, Chartered Accounting, 10001 |
| 13 | a | Chartered Accounting | 50000 | a, Chartered Accounting, 50000 |
| 14 | a | Chartered Accounting | 49999 | a, Chartered Accounting, 49999 |
| 15 | a | Chartered Accounting | 25000 | a, Chartered Accounting, 25000 |
| 16 | a | Chartered Accounting | 10000 | a, Chartered Accounting, 10000 |
| 17 | a | Chartered Accounting | 10001 | a, Chartered Accounting, 10001 |
| 18 | a | Chartered Accounting | 50000 | a, Chartered Accounting, 50000 |
| 19 | a | Chartered Accounting | 49999 | a, Chartered Accounting, 49999 |
| 20 | a | Chartered Accounting | 25000 | a, Chartered Accounting, 25000 |
| 21 | a | Information | 10000 | a, Information, 10000 |
| 22 | a | Information | 10001 | a, Information, 10001 |
| 23 | a | Information | 50000 | a, Information, 50000 |
| 24 | a | Information | 49999 | a, Information, 49999 |
| 25 | a | Information | 25000 | a, Information, 25000 |
| 26 | ab | C | 10000 | ab, C, 10000 |
| 27 | ab | C | 10001 | ab, C, 10001 |
| 28 | ab | C | 50000 | ab, C, 50000 |
| 29 | ab | C | 49999 | ab, C, 49999 |
| 30 | ab | C | 25000 | ab, C, 25000 |
| 31 | ab | CA | 10000 | ab, CA, 10000 |
| 32 | ab | CA | 10001 | ab, CA, 10001 |
| 33 | ab | CA | 50000 | ab, CA, 50000 |
| 34 | ab | CA | 49999 | ab, CA, 49999 |
| 35 | ab | CA | 25000 | ab, CA, 25000 |
| 36 | ab | Chartered Accounting | 10000 | ab, Chartered Accounting, 10000 |
| 37 | ab | Chartered Accounting | 10001 | ab, Chartered Accounting, 10001 |
| 38 | ab | Chartered Accounting | 50000 | ab, Chartered Accounting, 50000 |
| 39 | ab | Chartered Accounting | 49999 | ab, Chartered Accounting, 49999 |
| 40 | ab | Chartered Accounting | 25000 | ab, Chartered Accounting, 25000 |
| 41 | ab | Chartered Accounting | 10000 | ab, Chartered Accounting, 10000 |
| 42 | ab | Chartered Accounting | 10001 | ab, Chartered Accounting, 10001 |
| 43 | ab | Chartered Accounting | 50000 | ab, Chartered Accounting, 50000 |
| 44 | ab | Chartered Accounting | 49999 | ab, Chartered Accounting, 49999 |
| 45 | ab | Chartered Accounting | 25000 | ab, Chartered Accounting, 25000 |
| 46 | ab | Information | 10000 | ab, Information,10000 |
| 47 | ab | Information | 10001 | ab, Information, 10001 |
| 48 | ab | Information | 50000 | ab, Information, 50000 |
| 49 | ab | Information | 49999 | ab, Information, 49999 |
| 50 | ab | Information | 25000 | ab, Information, 25000 |
| 51 | abcdefghijklmnopqrstuvwxyzabcd | C | 10000 | abcdefghijklmnopqrstuvwxyzabcd, C, 10000 |
| 52 | abcdefghijklmnopqrstuvwxyzabcd | C | 10001 | abcdefghijklmnopqrstuvwxyzabcd, C, 10001 |
| 53 | abcdefghijklmnopqrstuvwxyzabcd | C | 50000 | abcdefghijklmnopqrstuvwxyzabcd, C, 50000 |
| 54 | abcdefghijklmnopqrstuvwxyzabcd | C | 49999 | abcdefghijklmnopqrstuvwxyzabcd, C, 49999 |
| 55 | abcdefghijklmnopqrstuvwxyzabcd | C | 25000 | abcdefghijklmnopqrstuvwxyzabcd, C, 25000 |
| 56 | abcdefghijklmnopqrstuvwxyzabcd | CA | 10000 | abcdefghijklmnopqrstuvwxyzabcd, CA, 10000 |
| 57 | abcdefghijklmnopqrstuvwxyzabcd | CA | 10001 | abcdefghijklmnopqrstuvwxyzabcd, CA, 10001 |
| 58 | abcdefghijklmnopqrstuvwxyzabcd | CA | 50000 | abcdefghijklmnopqrstuvwxyzabcd, CA, 50000 |
| 59 | abcdefghijklmnopqrstuvwxyzabcd | CA | 49999 | abcdefghijklmnopqrstuvwxyzabcd, CA, 49999 |
| 60 | abcdefghijklmnopqrstuvwxyzabcd | CA | 25000 | abcdefghijklmnopqrstuvwxyzabcd, CA, 25000 |
| 61 | abcdefghijklmnopqrstuvwxyzabcd | Chartered Accounting | 10000 | abcdefghijklmnopqrstuvwxyzabcd, Chartered Accounting, 10000 |
| 62 | abcdefghijklmnopqrstuvwxyzabcd | Chartered Accounting | 10001 | abcdefghijklmnopqrstuvwxyzabcd, Chartered Accounting, 10001 |
| 63 | abcdefghijklmnopqrstuvwxyzabcd | Chartered Accounting | 50000 | abcdefghijklmnopqrstuvwxyzabcd, Chartered Accounting, 50000 |
| 64 | abcdefghijklmnopqrstuvwxyzabcd | Chartered Accounting | 49999 | abcdefghijklmnopqrstuvwxyzabcd, Chartered Accounting, 49999 |
| 65 | abcdefghijklmnopqrstuvwxyzabcd | Chartered Accounting | 25000 | abcdefghijklmnopqrstuvwxyzabcd, Chartered Accounting, 25000 |
| 66 | abcdefghijklmnopqrstuvwxyzabcd | Chartered Accounting | 10000 | abcdefghijklmnopqrstuvwxyzabcd, Chartered Accounting, 10000 |
| 67 | abcdefghijklmnopqrstuvwxyzabcd | Chartered Accounting | 10001 | abcdefghijklmnopqrstuvwxyzabcd, Chartered Accounting, 10001 |
| 68 | abcdefghijklmnopqrstuvwxyzabcd | Chartered Accounting | 50000 | abcdefghijklmnopqrstuvwxyzabcd, Chartered Accounting, 50000 |
| 69 | abcdefghijklmnopqrstuvwxyzabcd | Chartered Accounting | 49999 | abcdefghijklmnopqrstuvwxyzabcd, Chartered Accounting, 49999 |
| 70 | abcdefghijklmnopqrstuvwxyzabcd | Chartered Accounting | 25000 | abcdefghijklmnopqrstuvwxyzabcd, Chartered Accounting, 25000 |
| 71 | abcdefghijklmnopqrstuvwxyzabcd | Information | 10000 | abcdefghijklmnopqrstuvwxyzabcd, Information, 10000 |
| 72 | abcdefghijklmnopqrstuvwxyzabcd | Information | 10001 | abcdefghijklmnopqrstuvwxyzabcd, Information, 10001 |
| 73 | abcdefghijklmnopqrstuvwxyzabcd | Information | 50000 | abcdefghijklmnopqrstuvwxyzabcd, Information, 50000 |
| 74 | abcdefghijklmnopqrstuvwxyzabcd | Information | 49999 | abcdefghijklmnopqrstuvwxyzabcd, Information, 49999 |
| 75 | abcdefghijklmnopqrstuvwxyzabcd | Information | 25000 | abcdefghijklmnopqrstuvwxyzabcd, Information, 25000 |
| 76 | abcdefghijklmnopqrstuvwxyzabc | C | 10000 | Abcdefghijklmnopqrstuvwxyzabc, C, 10000 |
| 77 | abcdefghijklmnopqrstuvwxyzabc | C | 10001 | abcdefghijklmnopqrstuvwxyzabc, C, 10001 |
| 78 | abcdefghijklmnopqrstuvwxyzabc | C | 50000 | abcdefghijklmnopqrstuvwxyzabc,C,50000 |
| 79 | abcdefghijklmnopqrstuvwxyzabc | C | 49999 | abcdefghijklmnopqrstuvwxyzabc,C,49999 |
| 80 | abcdefghijklmnopqrstuvwxyzabc | C | 25000 | abcdefghijklmnopqrstuvwxyzabc,C,25000 |
| 81 | abcdefghijklmnopqrstuvwxyzabc | CA | 10000 | abcdefghijklmnopqrstuvwxyzabc,CA,10000 |
| 82 | abcdefghijklmnopqrstuvwxyzabc | CA | 10001 | abcdefghijklmnopqrstuvwxyzabc,CA,10001 |
| 83 | abcdefghijklmnopqrstuvwxyzabc | CA | 50000 | abcdefghijklmnopqrstuvwxyzabc,CA,50000 |
| 84 | abcdefghijklmnopqrstuvwxyzabc | CA | 49999 | abcdefghijklmnopqrstuvwxyzabc,CA,49999 |
| 85 | abcdefghijklmnopqrstuvwxyzabc | CA | 25000 | abcdefghijklmnopqrstuvwxyzabc,CA,25000 |
| 86 | abcdefghijklmnopqrstuvwxyzabc | Chartered Accounting | 10000 | abcdefghijklmnopqrstuvwxyzabc,Chartered Accounting,10000 |
| 87 | abcdefghijklmnopqrstuvwxyzabc | Chartered Accounting | 10001 | abcdefghijklmnopqrstuvwxyzabc,Chartered Accounting,10001 |
| 88 | abcdefghijklmnopqrstuvwxyzabc | Chartered Accounting | 50000 | abcdefghijklmnopqrstuvwxyzabc, Chartered Accounting, 50000 |
| 89 | abcdefghijklmnopqrstuvwxyzabc | Chartered Accounting | 49999 | abcdefghijklmnopqrstuvwxyzabc, Chartered Accounting, 49999 |
| 90 | abcdefghijklmnopqrstuvwxyzabc | Chartered Accounting | 25000 | abcdefghijklmnopqrstuvwxyzabc, Chartered Accounting, 25000 |
| 91 | abcdefghijklmnopqrstuvwxyzabc | Chartered Accounting | 10000 | abcdefghijklmnopqrstuvwxyzabc, Chartered Accounting, 10000 |
| 92 | abcdefghijklmnopqrstuvwxyzabc | Chartered Accounting | 10001 | abcdefghijklmnopqrstuvwxyzabc, Chartered Accounting, 10001 |
| 93 | abcdefghijklmnopqrstuvwxyzabc | Chartered Accounting | 50000 | abcdefghijklmnopqrstuvwxyzabc, Chartered Accounting, 50000 |
| 94 | abcdefghijklmnopqrstuvwxyzabc | Chartered Accounting | 49999 | abcdefghijklmnopqrstuvwxyzabc, Chartered Accounting, 49999 |
| 95 | abcdefghijklmnopqrstuvwxyzabc | Chartered Accounting | 25000 | abcdefghijklmnopqrstuvwxyzabc, Chartered Accounting, 25000 |
| 96 | abcdefghijklmnopqrstuvwxyzabc | Information | 10000 | abcdefghijklmnopqrstuvwxyzabc, Information, 10000 |
| 97 | abcdefghijklmnopqrstuvwxyzabc | Information | 10001 | abcdefghijklmnopqrstuvwxyzabc, Information, 10001 |
| 98 | abcdefghijklmnopqrstuvwxyzabc | Information | 50000 | abcdefghijklmnopqrstuvwxyzabc, Information, 50000 |
| 99 | abcdefghijklmnopqrstuvwxyzabc | Information | 49999 | abcdefghijklmnopqrstuvwxyzabc, Information, 49999 |
| 100 | abcdefghijklmnopqrstuvwxyzabc | Information | 25000 | abcdefghijklmnopqrstuvwxyzabc, Information, 25000 |
| 101 | B. M. Shahria Alam | C | 10000 | B. M. Shahria Alam, C, 10000 |
| 102 | B. M. Shahria Alam | C | 10001 | B. M. Shahria Alam, C, 10001 |
| 103 | B. M. Shahria Alam | C | 50000 | B. M. Shahria Alam, C, 50000 |
| 104 | B. M. Shahria Alam | C | 49999 | B. M. Shahria Alam, C, 49999 |
| 105 | B. M. Shahria Alam | C | 25000 | B. M. Shahria Alam, C, 25000 |
| 106 | B. M. Shahria Alam | CA | 10000 | B. M. Shahria Alam, CA, 10000 |
| 107 | B. M. Shahria Alam | CA | 10001 | B. M. Shahria Alam, CA, 10001 |
| 108 | B. M. Shahria Alam | CA | 50000 | B. M. Shahria Alam, CA, 50000 |
| 109 | B. M. Shahria Alam | CA | 49999 | B. M. Shahria Alam, CA, 49999 |
| 110 | B. M. Shahria Alam | CA | 25000 | B. M. Shahria Alam, CA, 25000 |
| 111 | B. M. Shahria Alam | Chartered Accounting | 10000 | B. M. Shahria Alam, Chartered Accounting, 10000 |
| 112 | B. M. Shahria Alam | Chartered Accounting | 10001 | B. M. Shahria Alam, Chartered Accounting, 10001 |
| 113 | B. M. Shahria Alam | Chartered Accounting | 50000 | B. M. Shahria Alam, Chartered Accounting, 50000 |
| 114 | B. M. Shahria Alam | Chartered Accounting | 49999 | B. M. Shahria Alam, Chartered Accounting, 49999 |
| 115 | B. M. Shahria Alam | Chartered Accounting | 25000 | B. M. Shahria Alam, Chartered Accounting, 25000 |
| 116 | B. M. Shahria Alam | Chartered Accounting | 10000 | B. M. Shahria Alam, Chartered Accounting, 10000 |
| 117 | B. M. Shahria Alam | Chartered Accounting | 10001 | B. M. Shahria Alam, Chartered Accounting, 10001 |
| 118 | B. M. Shahria Alam | Chartered Accounting | 50000 | B. M. Shahria Alam, Chartered Accounting, 50000 |
| 119 | B. M. Shahria Alam | Chartered Accounting | 49999 | B. M. Shahria Alam, Chartered Accounting, 49999 |
| 120 | B. M. Shahria Alam | Chartered Accounting | 25000 | B. M. Shahria Alam, Chartered Accounting, 25000 |
| 121 | B. M. Shahria Alam | Information | 10000 | B. M. Shahria Alam, Information, 10000 |
| 122 | B. M. Shahria Alam | Information | 10001 | B. M. Shahria Alam, Information, 10001 |
| 123 | B. M. Shahria Alam | Information | 50000 | B. M. Shahria Alam, Information, 50000 |
| 124 | B. M. Shahria Alam | Information | 49999 | B. M. Shahria Alam, Information, 49999 |
| 125 | B. M. Shahria Alam | Information | 25000 | B. M. Shahria Alam, Information, 25000 |

# **Question 4**

A university is admitting students in a professional course subject to the following conditions:

(a) Marks in Java ≥ 70

(b) Marks in C++ ≥ 60

(c) Marks in OOAD ≥ 60

(d) Total in all three subjects ≥ 220 OR Total in Java and C++ ≥ 150

If the aggregate mark of an eligible candidate is more than 240, he will be eligible for scholarship course, otherwise he will be eligible for normal course. The program reads the marks in the three subjects and generates the following outputs:

(i) Not eligible

(ii) Eligible for scholarship course

(iii) Eligible for normal course

**Solution:**

First, we partition the domain of input in terms of valid input values and invalid values, getting the following classes:

I1 = {<Java, C++, OOAD>: Java ≥ 70}

I2 = {<Java, C++, OOAD>: C++ ≥ 60}

I3 = {<Java, C++, OOAD>: OOAD ≥ 60}

I4 = {<Java, C++, OOAD>: Java < 70}

I5 = {<Java, C++, OOAD>: C++ < 60}

I6 = {<Java, C++, OOAD>: OOAD< 60}

I7 = {<Java, C++, OOAD>: Total in all three subjects ≥ 220 OR Total in Java and C++ ≥ 150}

I8 = {<Java, C++, OOAD>: Total in all three subjects < 220 OR Total in Java and C++ < 150}

I9 = {<Java, C++, OOAD>: Aggregate marks > 240}

I10 = {<Java, C++, OOAD>: Aggregate marks ≤ 240}

The test cases can be designed from the above-derived classes, taking one test case from each class such that the test case covers maximum valid input classes and separate test cases for each invalid class. The test cases are shown below:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test ID** | **Java** | **C++** | **OOAD** | **Aggregate Marks** | **Expected Output** | **Classes Covered by the test case** |
| 1 | 70 | 75 | 60 | 224 | Eligible for normal course | I1, I2, I3, I7, I10 |
| 2 | 75 | 75 | 70 | 220 | Eligible for normal course | I1, I2, I3, I7, I10 |
| 3 | 75 | 74 | 91 | 242 | Eligible for scholarship course | I1, I2, I3, I7, I9 |
| 4 | 76 | 77 | 89 | 242 | Eligible for scholarship course | I1, I2, I3, I7, I9 |
| 5 | 68 | 78 | 80 | 226 | Not eligible | I4, I8 |
| 6 | 78 | 45 | 78 | 201 | Not eligible | I5, I8 |
| 7 | 80 | 80 | 50 | 210 | Not eligible | I6, I8 |
| 8 | 70 | 72 | 70 | 212 | Not eligible | I1, I2, I3, I8 |
| 9 | 75 | 75 | 70 | 220 | Eligible for normal course | I1, I2, I3, I7, I10 |
| 10 | 76 | 80 | 85 | 241 | Eligible for scholarship course | I1, I2, I3, I7, I9 |