**Software Quality Assurance and Testing Technology Assignment 3**

**Black Box Testing**

Q1: The New Telephone Company has the following rate structure for long distance calls:

* Any call started at or after 6:00 p.m. (1800 hours) but before 8:00 a.m. (0800 hours) is discounted 50%.
* Any call started at or after 8:00 a.m. (0800 hours) but before 6:00 p.m. (1800 hours) is charged full price.
* All calls are subject to a 4% Federal tax.
* The regular rate for a call is $0.40 per minute.
* Any call longer than 60 minutes receives a 15% discount on its cost (after any other discount is subtracted but before tax is added).

A computer program reads the start time for a call based on a 24-hour clock and the length of the call. The gross cost (before any discounts or tax) is printed followed by the net cost (after discounts are deducted and tax is added).

The program will assume only whole number values are input, that the duration is non-negative and the start time represents a real clock time. Results are rounded to the nearest cent.

Exercise:

1. Write a complete set of Black Box test cases (including equivalence classes and boundary value analysis) for testing of the program which solves the problem above.
2. After equivalence classes and boundary value analysis, please create a test case table, including a complete description field for the purpose of the each test case.
3. Is there any unclear description in the requirement?

1.

|  |  |  |
| --- | --- | --- |
| Value | Equivalence classes | Boundary value |
| start time | [0:00, 8:00) | 0:00, 0:01, 4:00, 7:59 |
| [8:00, 18:00) | 8:00, 8:01, 10:00, 17:59 |
| [18:00, 23:59] | 18:00, 18:01, 20:00, 23:58, 23:59 |
| duration | [0,60] | 0, 1, 30, 59, 60 |
| (60, MAX] | 61, 70, MAX-1, MAX |

2.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Case | Start time | duration | Complete description field | Excepted Outcomes |
| 1 | 0:00 | 30 | 0:00开始时打折50%，时长30分钟不超过60分钟不打折 | $12, $6.24 |
| 2 | 0:01 | 30 | 0:01开始时打折50%，时长30分钟不超过60分钟不打折 | $12, $6.24 |
| 3 | 4:00 | 30 | 4:00开始时打折50%，时长30分钟不超过60分钟不打折 | $12, $6.24 |
| 4 | 7:59 | 30 | 7:59开始时打折50%，时长30分钟不超过60分钟不打折 | $12, $6.24 |
| 5 | 8:00 | 30 | 8:00开始时不打折，时长30分钟不超过60分钟不打折 | $12, $12.48 |
| 6 | 8:01 | 30 | 8:01开始时不打折，时长30分钟不超过60分钟不打折 | $12, $12.48 |
| 7 | 10:00 | 30 | 10:00开始时不打折，时长30分钟不超过60分钟不打折 | $12, $12.48 |
| 8 | 17:59 | 30 | 17:59开始时不打折，时长30分钟不超过60分钟不打折 | $12, $12.48 |
| 9 | 18:00 | 30 | 18:00开始时打折50%，时长30分钟不超过60分钟不打折 | $12, $6.24 |
| 10 | 18:01 | 30 | 18:01开始时打折50%，时长30分钟不超过60分钟不打折 | $12, $6.24 |
| 11 | 20:00 | 30 | 20:00开始时打折50%，时长30分钟不超过60分钟不打折 | $12, $6.24 |
| 12 | 23:58 | 30 | 23:58开始时打折50%，时长30分钟不超过60分钟不打折 | $12, $6.24 |
| 13 | 23:59 | 30 | 23:59开始时打折50%，时长30分钟不超过60分钟不打折 | $12, $6.24 |
| 14 | 0:00 | 70 | 0:00开始时打折50%，时长70分钟超过60分钟打折15% | $28, $12.376 |
| 15 | 0:01 | 70 | 0:01开始时打折50%，时长70分钟超过60分钟打折15% | $28, $12.376 |
| 16 | 4:00 | 70 | 4:00开始时打折50%，时长70分钟超过60分钟打折15% | $28, $12.376 |
| 17 | 7:59 | 70 | 7:59开始时打折50%，时长70分钟超过60分钟打折15% | $28, $12.376 |
| 18 | 8:00 | 70 | 8:00开始时不打折，时长70分钟超过60分钟打折15% | $28, $24.752 |
| 19 | 8:01 | 70 | 8:01开始时不打折，时长70分钟超过60分钟打折15% | $28, $24.752 |
| 20 | 10:00 | 70 | 10:00开始时不打折，时长70分钟超过60分钟打折15% | $28, $24.752 |
| 21 | 17:59 | 70 | 17:59开始时不打折，时长70分钟超过60分钟打折15% | $28, $24.752 |
| 22 | 18:00 | 70 | 18:00开始时打折50%，时长70分钟超过60分钟打折15% | $28, $12.376 |
| 23 | 18:01 | 70 | 18:01开始时打折50%，时长70分钟超过60分钟打折15% | $28, $12.376 |
| 24 | 20:00 | 70 | 20:00开始时打折50%，时长70分钟超过60分钟打折15% | $28, $12.376 |
| 25 | 23:58 | 70 | 23:58开始时打折50%，时长70分钟超过60分钟打折15% | $28, $12.376 |
| 26 | 23:59 | 70 | 23:59开始时打折50%，时长70分钟超过60分钟打折15% | $28, $12.376 |
| 27 | 4:00 | 0 | 4:00开始时打折50%，时长0分钟不超过60分钟不打折 | $0, $0 |
| 28 | 10:00 | 0 | 10:00开始时不打折，时长0分钟不超过60分钟不打折 | $0, $0 |
| 29 | 20:00 | 0 | 20:00开始时打折50%，时长0分钟不超过60分钟不打折 | $0, $0 |
| 30 | 4:00 | 1 | 4:00开始时打折50%，时长1分钟不超过60分钟不打折 | $0.4, $0.208 |
| 31 | 10:00 | 1 | 10:00开始时不打折，时长1分钟不超过60分钟不打折 | $0.4, $0.416 |
| 32 | 20:00 | 1 | 20:00开始时打折50%，时长1分钟不超过60分钟不打折 | $0.4, $0.208 |
| 33 | 4:00 | 59 | 4:00开始时打折50%，时长59分钟不超过60分钟不打折 | $23.6, $12.272 |
| 34 | 10:00 | 59 | 10:00开始时不打折，时长59分钟不超过60分钟不打折 | $23.6. $24.544 |
| 35 | 20:00 | 59 | 20:00开始时打折50%，时长59分钟不超过60分钟不打折 | $23.6, $12.272 |
| 36 | 4:00 | 60 | 4:00开始时打折50%，时长60分钟不超过60分钟不打折 | $24, $12.48 |
| 37 | 10:00 | 60 | 10:00开始时不打折，时长60分钟不超过60分钟不打折 | $24, $24.96 |
| 38 | 20:00 | 60 | 20:00开始时打折50%，时长60分钟不超过60分钟不打折 | $24, $12.48 |
| 39 | 4:00 | 61 | 4:00开始时打折50%，时长61分钟超过60分钟打折15% | $24.4, $10.7848 |
| 40 | 10:00 | 61 | 10:00开始时不打折，时长61分钟超过60分钟打折15% | $24.4, $21.5696 |
| 41 | 20:00 | 61 | 20:00开始时打折50%，时长61分钟超过60分钟打折15% | $24.4, $10.7848 |
| 42 | 4:00 | 70 | 4:00开始时打折50%，时长70分钟超过60分钟打折15% | $28, $12.376 |
| 43 | 10:00 | 70 | 10:00开始时不打折，时长70分钟超过60分钟打折15% | $28, $12.376 |
| 44 | 20:00 | 70 | 20:00开始时打折50%，时长70分钟超过60分钟打折15% | $28, $12.376 |
| 45 | 4:00 | MAX -1 | 4:00开始时打折50%，时长MAX-1分钟超过60分钟打折15% | $(0.4×(MAX-1)), $(0.1768(MAX-1)) |
| 46 | 10:00 | MAX -1 | 10:00开始时不打折，时长MAX-1分钟超过60分钟打折15% | $(0.4×(MAX-1)), $(0.3536(MAX-1)) |
| 47 | 20:00 | MAX -1 | 20:00开始时打折50%，时长MAX-1分钟超过60分钟打折15% | $(0.4×(MAX-1)), $(0.1768(MAX-1)) |
| 48 | 4:00 | MAX | 4:00开始时打折50%，时长MAX分钟超过60分钟打折15% | $(0.4×(MAX)), $(0.1768(MAX)) |
| 49 | 10:00 | MAX | 10:00开始时不打折，时长MAX分钟超过60分钟打折15% | $(0.4×(MAX)), $(0.3536(MAX)) |
| 50 | 20:00 | MAX | 20:00开始时打折50%，时长MAX分钟超过60分钟打折15% | $(0.4×(MAX)), $(0.1768(MAX)) |

3.

若没有超过60分钟的折扣，Federal tax是基于总价算的还是打折后的价格算的。

Q2: Imagine a program which reads in the length of three sides of a triangle and outputs a message naming the kind of triangle: EQUILATERAL, ISOSCELES, or SCALENE.

Length not in range 1 - 99 cause error message INVALID INPUT.

If lengths don't make a triangle, output NOT A TRIANGLE.

Assumptions (pre-conditions for your program)

* Three lengths are entered separated by blanks or returns.
* Input of decimals or characters causes unpredictable results.
* Input from keyboard, simple text output to display.
* Even though equilateral triangle is also isosceles, only print EQUILATERAL.

Exercise:

1. Write a complete set of Black Box test cases (including equivalence classes and boundary value analysis) for testing of the program which solves the problem above.
2. After equivalence classes and boundary value analysis, please create a table like the one below, including a complete description field for the purpose of the each test case.
3. Is there any unclear description in the requirement?

1.

|  |  |  |
| --- | --- | --- |
| value | Equivalence classes | Boundary value |
| Side1 | [Min, 0](int) | Min, Min+1, -5,-1.0 |
| [1,99](int) | 1, 2, 50, 98, 99 |
| [100, MAX](int) | 100, 101, 150, MAX-1, MAX |
| Decimal | 0.1 |
| Characters | A |
| Side2 | [Min, 0](int) | Min, Min+1, -5,-1.0 |
| [1,99](int) | 1, 2, 50, 98, 99 |
| [100, MAX](int) | 100, 101, 150, MAX-1, MAX |
| Decimal | 0.1 |
| Characters | A |
| Side3 | [Min, 0](int) | Min, Min+1, -5,-1.0 |
| [1,99](int) | 1, 2, 50, 98, 99 |
| [100, MAX](int) | 100, 101, 150, MAX-1, MAX |
| Decimal | 0.1 |
| Characters | A |

2.

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| --- | --- | --- | --- | --- | --- |
| Case | Side1 | Side2 | Side3 | Complete description field | Expected outcomes |
| 1 | 50 | -5 | 50 | 有两条边不在范围内 | INVALID INPUT |
| 2 | 50 | -5 | -5 | 有一条边不在范围内 | INVALID INPUT |
| 3 | -5 | -5 | -5 | 有三条边不在范围内 | INVALID INPUT |
| 4 | 50 | 50 | A | 有一条边输入字符 | Unpredictable results |
| 5 | 50 | A | A | 有两条边输入字符 | Unpredictable results |
| 6 | A | A | A | 有三条边输入字符 | Unpredictable results |
| 7 | 50 | 50 | 0.1 | 有一条边输入小数 | Unpredictable results |
| 8 | 50 | 0.1 | 0.1 | 有两条边输入小数 | Unpredictable results |
| 9 | 0.1 | 0.1 | 0.1 | 有三条边输入小数 | Unpredictable results |
| 10 | 50 | -5 | A | 有一条边不在范围内，有一条边输入字符 | INVALID INPUT &  Unpredictable results |
| 11 | -5 | -5 | A | 有两条边不在范围内，有一条边输入字符 | INVALID INPUT &  Unpredictable results |
| 12 | -5 | A | A | 有一条边不在范围内，有两条边输入字符 | INVALID INPUT &  Unpredictable results |
| 13 | 50 | -5 | 0.1 | 有一条边不在范围内，有一条边输入小数 | INVALID INPUT &  Unpredictable results |
| 14 | -5 | -5 | 0.1 | 有两条边不在范围内，有一条边输入小数 | INVALID INPUT &  Unpredictable results |
| 15 | -5 | 0.1 | 0.1 | 有一条边不在范围内，有两条边输入小数 | INVALID INPUT &  Unpredictable results |
| 16 | 50 | A | 0.1 | 有一条边输入字符，有一条边输入小数 | Unpredictable results |
| 17 | A | A | 0.1 | 有两条边输入字符，有一条边输入小数 | Unpredictable results |
| 18 | A | 0.1 | 0.1 | 有一条边输入字符，有两条边输入小数 | Unpredictable results |
| 26 | 50 | 50 | 50 | 等边条件 | EQUILATERAL |
| 30 | 1 | 50 | 50 | 等腰条件 | ISOSCELES |
| 31 | 1 | 2 | 3 | 不构成三角形条件 | NOT A TRIANGLE |
| 33 | 50 | 98 | 99 | 不等边三角形条件 | SCALENE |

3.

判断不在范围内和判断输入小数或字符的优先级，最后的输出是INVALID INPUT还是Unpredictable results