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Part1

1.

(1) The difference between black box testing and white box testing is whether you can access the code. Black box testing cannot access the code, while white box testing can access the code.

(2) White box testing is used for unit testing, integration testing, regression testing, and security testing in software testing; black box testing is used for integration testing, regression testing, system testing, acceptance testing, performance testing, and security testing, usability testing, load testing, stress testing, reliability testing. Black box testing and white box testing are used in all stages of software testing to complete product testing.

(3)

- Use cause-effect analysis, equivalence analysis and other methods to select appropriate test cases and reduce the complexity of the test.
- Modify the software development test model, change the waterfall model to rapid development, let users valid the product earlier, and reduce the complexity of the test.
- Requirement specifications are written in more formal and mathematical terms to reduce the complexity of testing.
- Reduce the limitless possibilities to a controllable range, and how to make appropriate choices for software risks, go to the bottom, and find the best test volume, so that the test workload is not much, no less The purpose of the test can be more economical.

2.

(1) The difference between dynamic testing and static testing is whether to run the program. The dynamic test runs the program, while the static test does not run the program.

(2)

**List:**

- Customer Requirements (Surveys, competitive info, Feedback)
- Specifications
- Schedule
- Design Docs (Architecture, Feature implementation, Interface agreement)
- Test Documents (Plans, test cases, QA Milestone reports)
- Online help
- Release Notes / Read Me
- Release packages， code

**Level：**

- Unit testing
- Module testing
- Integration testing
- System testing
- Regression testing

(3)

We use static testing to view the interface, view the documentation, and view the code

We use dynamic testing to run and analyze the code structure and view the input and output

Static testing adopts schemes—code walkthrough, technical review, and code review to test software products. Dynamic testing tests software by constructing test instances, executing programs, and analyzing the output of programs.

Part2

1.

(1)

| Equivalence Class No. | Description of the class | Type |
|---|---|---|
| 1 | Item name is not alphabetic | Invalid |
| 2 | Length of item name is under 3 | Invalid |
| 3 | Length of item name is above 10 | Invalid |
| 4 | Item name is alphabetic and Length of item name is between 3 to 10 | Valid |
| 5 | The size is not number | Invalid |
| 6 | The size is below 1 | Invalid |
| 7 | The size is above 10 | Invalid |
| 8 | The size is number and The size is between 1 to 10 | Valid |
| 9 | The separator used is not a comma | Invalid |
| 10 | The separator used is a comma | Valid |
| 11 | The number of sizes entered is greater than 5 | Invalid |
| 12 | The number of sizes entered is between 1 to 5 | Valid |
| 13 | The sizes are to be entered in ascending order | Valid |
| 14 | The sizes to be entered in are not in ascending order | Invalid |
| 15 | The symbol following item name is not a comma | Invalid |

(2)

| No. | Test Data | Expected Outcome | Equivalence Classes Covered |
|---|---|---|---|
| 1 | A2Y,1 | F | 1 |
| 2 | AA,1 | F | 2 |
| 3 | ABCDEFGHIJK,1 | F | 3 |
| 4 | ABCD,1 | T | 4 |
| 5 | ABCD,R | F | 5 |
| 6 | ABCD,0 | F | 6 |

| | | | |
|---|---|---|---|
| 7 | ABCD,12 | F | 7 |
| 8 | ABCD,5 | T | 8 |
| 9 | ABCD,5/6 | F | 9 |
| 10 | ABCD,5,6 | T | 10 |
| 11 | ABCD,1,2,3,4,5,6 | F | 11 |
| 12 | ABCD,1,2,3,4 | T | 12 |
| 13 | ABCD,2,3,4,5 | T | 13 |
| 14 | ABCD,3,4,2,1 | F | 14 |
| 15 | ABCD/1,2,3,4 | F | 15 |

(3)

**Item name:**

Since the item name should be an alphabetic character of 3 to 10 characters, we need to analyze the case where the length of the item name is 0, 1, 2, 3, 4, 9, 10, and 11 and consider whether the name is a alphabetic character.

Test case:
,1,2,3
A,1,2,3
AB,1,2,3
ABC,1,2,3
ABCD,1,2,3
ABCDEFGHI,1,2,3
ABCDEFGHIJ,1,2,3
ABCDEFGHIJK,1,2,3
A2Y,1,2,3

**Item size:**

Since the item size should be an number of 1 to 10 number, we need to analyze the case where the size is 0, 1, 2, 9, 10, and 11 and consider whether the size is a number.

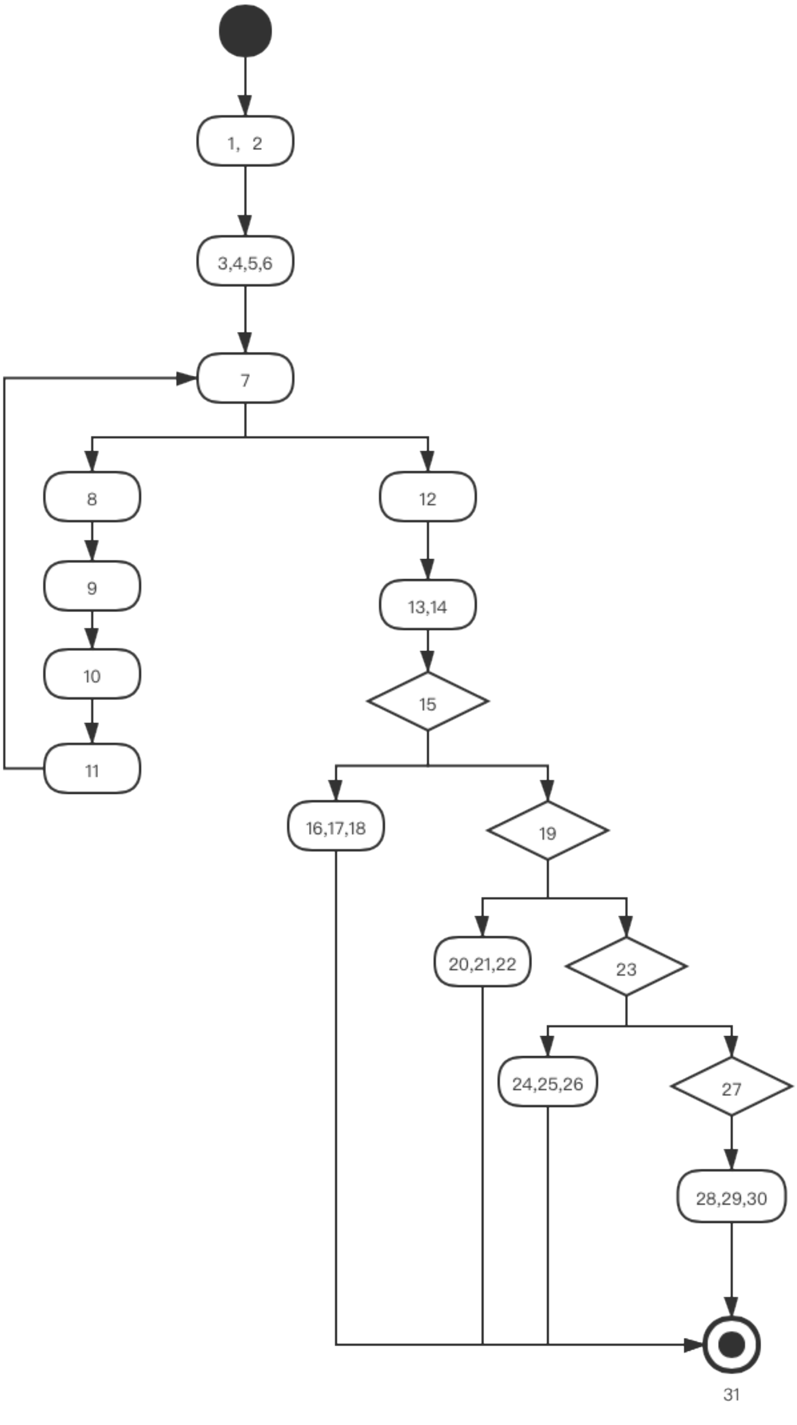
Test case:
ABCD,0
ABCD,0,1
ABCD,0,1,2
ABCD,9
ABCD,9,10
ABCD,9,10,11
ABCD,1.5,2

**Item list**：

Since a maximum of 5 sizes may be entered for each item, we need to analyze the case where the number of list is 0,1,4,5,6
Test case:

ABCD,
ABCD,5
ABCD,3,4,5,6
ABCD,3,4,5,6,7
ABCD,3,4,5,6,7,8

2
(1)



**cyclomatic complexity : V（G）=5**

(2)
Test case:
[75,80,85,90,92,95],[58,60,62,64,66,68],[50,48,46,52,47,49],[20,25,30,33,32,40]
In line 19,change **else if(avg>=60 && avg<80)** to else if(avg>=60)
In line 23,change **else if(avg>=40 && avg<60)** to else if(avg>=40)

Part3
1.
(1) The product should display the weather for the next 24 hours from the user's current usage time.
(2) If the water level exceeds 100 meters and the duration exceeds 4 seconds, the pump needs to be turned off.
(3) If the ATM accepts the card, the user needs to enter a PIN. If the ATM does not accept the card, the card is rejected and the user cannot enter the PIN.
(4) When the elevator is stationary on a certain floor, the elevator door can be opened on that floor. If the elevator is in a non- stationary state on the floor or on another floor, the elevator door cannot be opened on the floor.
(5) When the alarm sounds, the user can press the L and R buttons simultaneously and the alarm will turn off.
If the user presses the L button or R button alone or does not press any button, the alarm will continue.
2.
I think the most difficult thing is the runtime verification system, that is, the real-time verification of the UML diagram and code memory test cases in the specification. Because it requires a combination of developers, testers, and users, currently, only NASA develops runtime verification systems