Black Box Tests – Part I

**Designing test cases using**

**equivalence partitions, boundary value analysis and decision tables**

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# Instructions

Work in pairs – groups of two – and discuss with each other as you complete the exercise.

Each team should have two copies of these sheets (one for each person) so you can use one copy for rough work. Alternatively use scratch paper or an area on the white board for rough work.

**Marking**

This assignment is marked out of 10.

**Due**

Hand in or submit to eCentennial your joint solution before you leave class.

**This assignment has two goals**:

1. To practice techniques for designing black box tests that help ensure good code coverage. The theory is that testing all possible scenarios maximizes chances of following all possible paths through the code. Do not fall into the trap of making assumptions about how the application might be coded.

1. To practice specifying test cases. Clear documentation is important because test implementation and execution might be outsourced to people who have no experience with the business domain or knowledge of the application requirements.

Do not overlook or hesitate to state the obvious and pay attention to detail.

# Question 1

A program converts student marks that are input as marks out of 100 to letter grades following the rules below.

A mark of at least 90 earns A+

A mark of at least 80 earns A

A mark of at least 70 earns B

A mark of at least 60 earns C

A mark of at least 50 earns D

A mark below 50 means F (Failure)

If a student is excused from submitting 40% or more of the gradable work for acceptable reasons such as protracted illness, a mark of I (Incomplete) is given. Then the student can make arrangements to submit missing work to complete the course after the end of term.

**Note:** Numeric marks are recorded accurate to one decimal point (0.1) and should be rounded up to the nearest whole number (0.5+ → 1) by the grading program.

The **objective** of testing is to ensure that students are assigned the correct letter grade, given their numeric mark.

1. Draw the diagram to show **equivalence partitions** and **boundary values** that ensure all input values are tested **(0.5 pts)**

**Hint:** ignore the incomplete situation is

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Invalid | Valid | Valid | Valid | Valid | Valid | Valid | Invalid |
| 0 > | 0 - 50 | 50 – 60 | 60 - 70 | 70 - 80 | 80 - 90 | 90 - 100 | 100 < |
| -∞ - -0.1 | 0.1 -49.9 | 50 -59.9 | 60 -69.9 | 70 -79.9 | 80 -89.9 | 90 - 100 | * 1. - ∞ |

1. (0.5 pts) How many test cases do you think are required for complete coverage? 8 + 14 = 22 And why? (How many tests do you think are needed for each partition)

I think this because there are 8 partitions and there are 14 boundary values. So I added them together to get the amount of test cases.

1. (0.5 pts) Describe a test case where the expected result is a pass.

**Title:** Student gets an A

Setup: (preconditions)

Grading system is set up.

Action or input:

input a mark between 80 and 89.9.

Expected result:

System outputs A for student.

1. (0.5 pts) Describe a test case where the expected result not a pass

**Hint**: there are **two** possible non-pass situations. List them here to help form your title.

1 Student is excused from submitting 40% or more of the gradable work for acceptable reasons such as protracted illness, a mark of I (Incomplete) is given. 2 Student gets lower than 50% for their mark.

**Title: Student gets an F**

Setup:

Grading system is set up.

Action or input:

input a mark between 0 and 49.9.

Expected result:

System outputs F for student.

# Question 2

When asked for an insurance quotation, an auto insurance company looks up the base rate of insuring a specific make, model and year of car. It then multiplies the base rate by percentages according to the business rules below to calculate the quote for a customer:

* Drivers over 55 years of age with good driving records pay the 90% of the base rate.
* Drivers who are male and under 25 years of age pay 150% of the base rate.
* Anyone who uses the car for business pays a premium of 120% of what they would pay for personal use only.

**Example:** the base rate for a 2005 Honda Civic might be $500.00. A retired senior with a good driving record would pay $450.00 for coverage for insurance to drive 2005 Honda Civic. However, if that senior has a business as a messenger for which he uses the car, his rate becomes $540.00. a. (1 pts) Draw a decision table to calculate the quotation for a client **Hint:** start by deciding:

What are the conditions that determine outcomes?

- Sex, age, model, make, year of car, driving record, use of car

What are the possible outcomes?

- Quoted insurance rate

Draw your table here:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Condition** | **Rule 1** | **Rule 2** | **Rule 3** | **Rule 4** | **Rule 5** | **Rule 6** |
| Male < 25 | T | T | F | F | F | F |
| Use of car (T-business,  F-personal) | T | F | T | F | T | F |
| Senior with good driving record | F | F | F | F | T | T |
| **Actions/outcomes** |  |  |  |  |  |  |
| Base rate | Base rate \* 1.2 \* 1.5 | Base rate \* 1.5 | Base rate \* 1.2 | Base rate | Base rate  \* 1.2 \* 0.9 | Base rate \* 0.9 |

b. Use the decision table above to help design test cases for the test objective:

**Every driver who requests a quotation is told the correct rate.**

**Notes:**

**“**Criteria for success” refers to deciding whether application passes the test, not whether the driver gets insurance.

|  |  |
| --- | --- |
| **Test Case 1** (1 pts) | **Test Case 2** (1 pts) |
| Identifier/title  Senior with good driving record for personal use. | Identifier/title  A male less than 25 using the car for business. |
| Criteria for success:  Drivers over 55 years of age with good driving records pay the 90% of the base rate. | Criteria for success:  Drivers who are male and under 25 years of age pay 150% of the base rate.  Anyone who uses the car for business pays a premium of 120% of what they would pay for personal use only. |
| *Details:*  Preconditions  Make, model and year of the car are marked  Customer over 55 and has a good driving record  Customer also uses the car for personal use.    Operation/Action performed  Customer chooses car (make, model, and year)  Customer provides age, driving record, and sex  Customer states use of car    Postconditions  Give a quote of base rate \* 0.9 | *Details:*  Preconditions  Make, model and year of the car are marked  A male younger than 25 uses the car for business.      Operation/Action performed  Customer chooses car (make, model, and year)  Customer provides age, driving record, and sex  Customer states use of car    Postconditions  Give a quote of base rate \* \* 1.2 \* 1.5 |

# Question 3 (2 pts)

You are designing tests for an online banking application. A use case allows bank account owners to pay bills from their bank accounts. Before paying bills, an account owner with on-line access, must register payees (typically credit card and utilities providers) so that the bank knows who and how to pay. Then, the account owner can transfer funds from their bank accounts to pay bills on-line.

**Scenarios:**

The application should complete the bill payment if the bank account has enough funds or cancel otherwise.

* There is no service charge for online bill payment when the bank account has sufficient funds.
* If the bill amount is greater than the account balance, the application should send a notification to the client and charge a service fee of $5.00. If the bank account is less than $5.00, it will be left with a small negative balance.

Complete the table to define two test cases for each scenario in this use case.

|  |  |
| --- | --- |
| **Test case 1** (1 pts)  **Use Case scenario: successful bill payment** | **Test Case 2** (1 pts)  **Use case scenario: bill payment unsuccessful** |
| Identifier/title  Sufficient funds for bill payment | Identifier/title  Bill payment with low balance |
| Criteria for success:  There is no service charge for online bill payment when the bank account has sufficient funds. | Criteria for success:  The application should send a notification to the client and charge a service fee of $5.00. If the bank account is less than $5.00, it will be left with a small negative balance. |
| *Details:*  Preconditions  Customer must own an account  Account owner must register payees  Account must have enough funds  Operation/Action performed  The customer selects the payee for the bill payment.  The customer enters the bill amount and confirms the payment.  The application checks the bank account balance and determines that it is sufficient for the payment amount  The application notifies the user of the sufficient funds and changes balance.  Postconditions  Payment is successful  System updates it’s balance | *Details:*  Preconditions  Customer must own an account  Account owner must register payees  Account must have a low balance to cover bill    Operation/Action performed  The customer selects the payee for the bill payment.  The customer enters the bill amount and confirms the payment.  The application checks the bank account balance and determines that it is insufficient for the payment amount.  The application notifies the user of the insufficient funds and cancels the payment.  The account balance remains unchanged.  Postconditions  Payment is unsuccessful |

# Question 4 (1 pts)

The next phase of the online banking application described in the previous question handles checking accounts and savings accounts instead of generic bank accounts. Bill payment is allowed only on checking accounts under the following business rules (in order of priority):

1. If the checking account balance is equal or greater to the bill amount, pay the bill.
2. If the checking account balance is less than the bill amount and the user has prearranged overdraft protection that covers the amount, withdraw a service charge of $5.00 from the account and pay the bill, letting the account balance go below zero.
3. If the checking account balance is less than the bill amount and the account owner has a savings account that has enough funds, transfer enough money from the savings account to the checking account to pay the bill, complete payment and leave the checking account with a balance of zero.
4. If the checking account balance is less than the bill amount and the account owner does not have either overdraft protection or a savings account, do not make payment. Instead, send a notification to the client and charge a service fee of $5.00, possibly leaving a small negative balance in the checking account.

Decide what black box technique applies and then draw the diagram to represent the conditions and expected results in this phase application development. No test cases are required.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Condition | Rule 1 | Rule 2 | Rule 3 | Rule 4 | Rule 5 |
| Balance >= bill amount | T | F | F | F | F |
| Balance < bill amount && user has prearranged overdraft protection that covers the amount, | F | T | F | F | T |
| Balance < bill amount && owner has a savings account that has enough funds | F | F | T | F | T |
| Balance < bill amount && owner does not have either overdraft protection or a savings account | F | F | F | T | F |
| Action/Output |  |  |  |  |  |
| Payment | Pay bill | Withdraw a service charge of $5.00 from the account and pay the bill, letting the account balance go below zero. | Transfer enough money from the savings account to the checking account to pay the bill, complete payment and leave the checking account with a balance of zero | Do not make payment. Instead, send a notification to the client and charge a service fee of $5.00, possibly leaving a small negative balance in the checking account. | Withdraw a service charge of $5.00 from the account and pay the bill, letting the account balance go below zero. |