

TESTING ON THE PACKAGE PROGRAM USING THE BLACK BOX TESTING METHOD WITH THE EQUIVALENCE PARTITIONING TECHNIQUE

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ABSTRACT

Software testing that still uses the manual method is the main obstacle in this project, because using the manual method of testing that is carried out is less specific and may also be inaccurate. Manual testing is done by looking at existing concepts and implementing them in accordance with the sequence of concepts. This manual test is carried out during system testing and finds errors, then will make notes about these errors to be given to the ESD team for further improvement and is arguably less specific because the tests carried out in the Package Program section of the Package Department are quite numerous and complex with functions and logic that runs on the program. Software testing has many methods and techniques that can be used to support the tests carried out so that the results received are also more specific and accurate. In this test the author uses the Black Box Testing method with the Equivalence Partitioning technique. The Black Box Testing method was chosen because this method is a method of testing the functionality of a system without looking at the program code. Then the Equivalence Partitioning technique here is used to create a test case design to support testing based on the concepts that exist in the system. Testing with these methods and techniques was carried out 5 times to ensure the current system was running according to the concept or not and also every function and logic was running as expected or not. The expected results using the Black Box Testing method with this Equivalence Partitioning technique so that the tests carried out are more specific and can also be forwarded to the next test. The test success rate on this system is 94% by testing 50 test cases and 46 of them have the expected results. The Black Box Testing method with the Equivalence Partitioning technique is also in accordance with the needs in system testing which only tests system functionality without looking at the program code.

Keywords: *Manual, Black Box Testing, Equivalence Partitioning*

BACKGROUND

The selection of software testing methods at PT. Hartono Istana Teknologi is the main obstacle in conducting software testing. Software testing is needed in order to find out whether the system in PT. Hartono Istana Teknologi is good and functioning as expected or not. The manual testing process in this company became the main obstacle in testing software. Therefore the other software testing is implemented to determine the level of successful methods and techniques using the Black Box Testing method with Equivalence Partitioning technique.

Black Box Testing method is used to test the functionality or usability of an application, because it is enough to review the input and output of the software without knowing the program code. The Black Box Testing method has several techniques and also different ways, but in this test using the Equivalence Partitioning technique. Equivalence Partitioning is done by creating a test case based on the equivalence class for input conditions that describe a valid data set or not. Therefore, by knowing the level of success of the technical methods used, we can know whether the methods and techniques used can overcome the problems that existed before.

Software testing is expected to be able to overcome these problems properly, because in software testing it is necessary to think about methods and techniques that are needed. Rather than using the manual method, the use of Black Box Testing method and the Equivalence Partitioning technique will run the software testing process effectively and more specifically. Then from that we can find out that the system that is running is good and appropriate as expected and can make it easier for users to use the system because they have made a series of test cases that contains the functional testing of the system as a whole.

PROBLEM FORMULATION

The problem in this test is one of the main factors for later testing, therefore the author makes several questions to solve these problems, namely

1. How is the success rate of the system using the Black Box Testing Method with the Equivalence Partitioning technique?
2. What are the test results from the manual and when using the Black Box Testing method with the Equivalence Partitioning technique?

This project will be carried out at PT. Hartono Istana Teknologi. The Black Box Testing method with the Equivalence Partitioning technique will be used as a testing tool. It will be used on a package delivery program.

This research's goal is to be able to determine the direction of a study. The test is carried out using the Black Box Testing method with the Equivalence Partitioning technique because it is a functional test that is considered appropriate. Testing using software testing methods and techniques is expected to make the system more effective and specific than before and determine the level of success of the techniques used by using the Black Box Testing method and the Equivalence Partitioning technique to perform software testing on the system at PT. Hartono Istana Teknologi.

LITERATURE STUDY

The Black Box Testing method is used to perform Application Testing on Information Systems which is carried out using the Equivalence Partitioning technique [1]. These methods and techniques are proposed regarding the use, benefits, and results obtained from using the software.

Black box testing is done to design tests systematically to find the types of errors with the least time and effort. This Black Box testing targets the functional specifications of the software that has been created. The Equivalence Partitions technique is done by determining the first test case of the software to be tested. Testing using Black Box Testing with the Equivalence Partitioning technique can be an alternative solution for schools to test the accuracy of school information systems.

Testing the eCampus application using the Black Box Testing method with the Equivalence Partitioning technique done by doing the 7 stages that exist in the Equivalence Partitioning testing technique [2]. These stages start from determine use cases, determine criteria for each use case, create partitions based on criteria, create partitions, determine test data, determine test cases, perform tests based on test cases, and evaluate. The test is carried out according to the stages of the Equivalence Partitioning technique. From the test results it was found that the Equivalence Partitioning technique can be used with easy to perform tests based on test data and detailed test cases according to use cases and specified criteria previously.

Testing on a program is very necessary to check all errors in the program and reduce the occurrence of harmful errors [3]. Black Box testing is carried out on the application of performance data information using the Equivalence Partitioning technique. Testing is carried out based on input data on each form on the performance data information application system, each input menu will be tested and grouped based on its function whether it is valid or invalid. This test is carried out on 4 forms that will be filled with additional jobdesk form data, additional work target forms, work target edit forms, work target approval forms, and employee performance while in the company, by testing 2 times on each form so that it can be seen if there are any. errors or bugs in the functional testing process. The test results using Black Box focus on system input and output and the Equivalence Partitioning technique can help the case making process testing and quality determination as well as finding errors that exist and ensuring the application under test conforms to the desired functionality.

The use of the Black Box Testing method in testing Sales Applications with the Equivalence Partitioning technique is considered quite relevant because this method will test to solve or divide the program input domain into data classes so that test cases can be obtained [4]. The testing stages are carried out by determining the functionality to be tested, designing a test scenario, determining the data to be tested, determining the input can be a numeric value, a range of values, a collection of related values or Boolean conditions according to the database structure that has been created, conducting test experiments, documenting the results. testing, and drawing conclusions. Testing using Black Box Testing with the Equivalence Partitioning technique can run well, but it is hoped that other methods can be used so that the expected results can be better, because the test is only done using a sample form.

Software testing using the Black Box Testing method on the Mail Filing System Application by using Equivalence Partitioning technique is used to find errors or defects in an application and to test how far the capabilities of the application or system [5]. Testing with these methods and techniques is carried out on 2 forms on the mail archive application where each input menu will be tested and grouped based on its function whether it is true or false. Testing using the Black Box Testing Method and the Equivalence Partitioning technique can help find errors in the system that has been made before the system is used.

The Black Box Testing method in testing Web-Based Library Applications with the Equivalence Partitioning technique is applied to find errors in software related to incorrect functions, errors in the display interface, data structure errors or access rights to external databases, less than optimal processing, and errors. in initialization or termination, as well as to design test cases based on the premise of component input and output partitioned into classes according to component specifications, which are treated the same [6]. The test results from the Equivalence Partitioning stage show that the form has a function that has been running well and as expected, and proves that this technique can be used quite easily.

Testing on the train ticket booking application is carried out to minimize if an error occurs, this test is carried out using the Black Box Testing method with the Equivalence Partitioning technique by testing 2 forms, namely the login form and the train ticket booking form which will be filled in by the admin [7]. The Black Box Testing method is carried out to see whether the program is in accordance with the desired program function or not, the Equivalence Partitioning technique is used to perform tests based on data entry on each form on the system, each menu input will be tested and grouped based on its function, whether it is valuable or not. legal or invalid. From the use of the Black Box method and the Equivalence Partitioning technique in this test, it was found that the test went well without any problems and for the application no errors were found.

The use of the Black Box Testing method with the Equivalence Partitioning technique in a test on the Commuter Line Registration Application is based on data input on each form in the performance data information application system, each menu will be tested and grouped based on its function whether it is valid or invalid [8]. This test is carried out on 1 registration form by making a test case. The test is carried out 1x filling in valid data and 1x filling in invalid data. This Black Box testing only focuses on input and output, the Equivalence Partitioning technique can help the process of making test cases and determining quality as well as finding errors that exist and guaranteeing the application being tested is in accordance with the desired functionality.

Testing on the DAPODIKDASMEN Information System is carried out to ensure that this application has no errors and is suitable for use [9]. The proposed test is Black Box Testing using the Equivalence Partitioning technique so that errors/defects can be found and can be repaired immediately. Testing is done by creating test cases and grouping input values with valid and invalid values. The test results using the Black Box Testing method are needed so that each

software is tested for system errors, and by using the Equivalence Partitioning technique it is possible to find some errors and immediately fix them.

The use of the Black Box Testing method with the Equivalence Partitioning technique in testing the Electronic Sales Desktop Application is done by dividing or solving the program in the form of an input domain to the data class so that a test case can be obtained [10]. Tests implemented on functionality testing login form, transaction form, and buyer's biodata form. Testing is done by making a test case to conclude whether the Black Box testing with the Equivalence Partitioning technique is successful or not. Testing with these methods and techniques went well, but because the shape of the sample was still limited, this test was not perfect.

RESEARCH METHODOLOGY

Reading Concepts

First, this research was conducted by studying the concept of Artemis on the program package menu. Concepts are made based on UI and overall system Logic. After studying all the concepts from start to finish, it can be seen how functions and logic work in a system.

Creating test scenarios

After creating a concept, the next step is to plan the test by creating a scenario about what will be tested. Create a scenario according to what is in the concept. After creating the scenario, the author first tested the buttons and logic functions on the system to ensure how the system output was when testing a function.

Making Literature Study

After creating a scenario, you can see what will be tested and how it will be tested, then conduct a literature search regarding the tests to be carried out. The selection of software testing methods and techniques is done after reading the concept to fit the system to be tested. The literature search was carried out in accordance with predetermined software testing methods and techniques.

First test

The first test is carried out one by one according to the sequence of concepts that have been given. In the first test, when finding problems with buttons or running logic, the authors noted the obstacles found so that they could be used as material for improvement for the ESD team at PT. Hartono Istana Teknologi. Recording is done so that the ESD team can justify existing problems and then make improvements so that the system becomes even better and as expected.

Create a test case

After doing the first test to find out the system to be tested, the author makes a test case that contains the things that exist in the system to be tested. Testing is done by collecting data from each button function and logic. Test cases are made according to the function of the button and the logic that runs on the concept.

Testing according to the test case

Testing is carried out 5 times for each function to ensure the system runs as expected. Tests are also carried out sequentially according to the test case and concept to make it easier to review the test results. At the time after testing, the results are then written in the test case table as documentation that the test has been carried out.

Test results review

To review the test results using the Black Box Testing method with the Equivalence Partitioning technique. The review is done so that the author can find out how the test results need improvement or not. After reviewing the test results, the next step is to calculate the level of software testing using the Black Box Testing method with the Equivalence Partitioning technique.

ANALYSIS

The method used in this test is the Black Box Testing method. The used technique in this testing is Equivalence Partitioning technique. Black Box Testing method is a software testing method that tests software without knowing the internal structure of the code or program. In Black Box Testing, testing is carried out based on application details such as the appearance of the application, the functions that exist in the application, and the suitability of the function flow with the business processes desired by the customer. The Black Box Testing is more concern with the outer appearance (interface) of an application. Usually the testing looks for missing or incorrect functionality, interfaces, performance, program initialization, and exit errors, data structures or external database access errors.

Equivalence Partitioning is a Black Box testing method that splits or divides the input domain of the program into data classes so that test cases can be obtained. The design of the Equivalence Partitioning test case is based on the evaluation of the equivalence class for the input conditions that describe a valid data set or not. A test case is a design or series of actions taken by the user to verify certain features or functions of a software. Making a test case aims to ensure that a system can be run properly according to initial requirements and is able to respond when there is an invalid input.

Manual testing is done based on the concept by only noting if there are functions and logic that are not in accordance with the concept, while testing uses the Black Box Testing Method with the Equivalence Partitioning technique for testing based on concepts by creating test cases that contain the functions and logic to be tested. Basically the testing method between the 2 tests is different because the manual only records if there are errors, and those who use the Black Box Testing Method with the Equivalence Partitioning technique can find out which functions and logic are correct or which are still wrong. However, the test results of both yielded the same result.

Table 1. Table Data Analysis (Perancangan Test Case)

No	Test Case	Expected Result
A01	When Filter Data button is clicked, then input field for Filter Data is shown	Input field for Filter Data is shown
A02	When Need Approval button is clicked, then moved to Need Approval Table	Changed to Need Approval Table from table Packages
A03	If has menu access Approve, then approve button in Need Approval table will appear	Approve button appears
B01	Field Process Document Number dan Document Number will be automatically filled with temporary number	Field automatically filled with temporary number
B02	Package Category pick "Internal" as the default and could be changed to "External"	Defaulted in "Internal" and can be changed to "External"
C01	Package Category, Cost Allocation, Expedition Type could be changed	Can be changed and unlocked or empty
C02	Sender and Recipient : "Internal" and "External" data in edit form must be the same with when new form are added and can be edited	Data must be the same and the fields must not have blanks or different than the filled in data when adding new data.

From the table 1 above, at row A01, it is shown that when the data filter button is clicked, the input filter data will appear. At Row B02, the Package Category field is defaulted to "Internal" and can be changed to "External", when opening the new menu a form will appear to add a new package, the Package Category field is defaulted to "Internal" and can be changed to "External". At Row C01, the Package Category, Cost Allocation, Expedition Type columns must be changeable and cannot be empty.

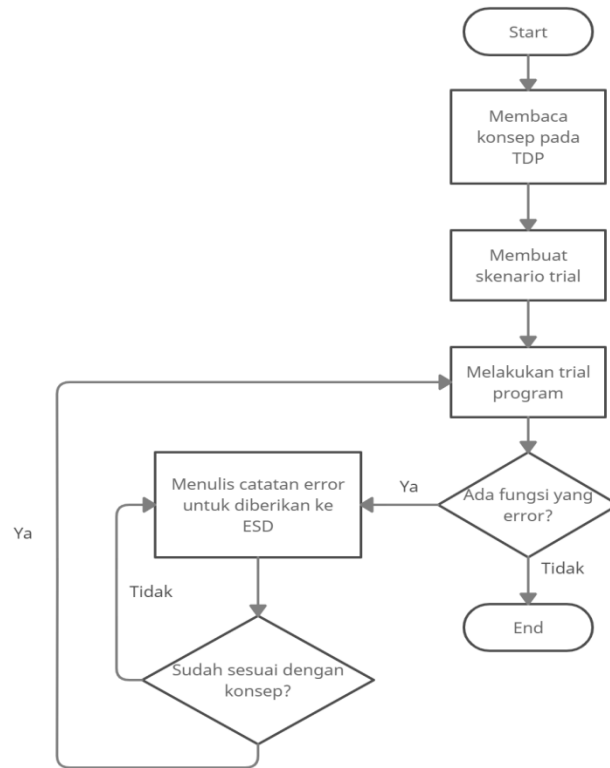


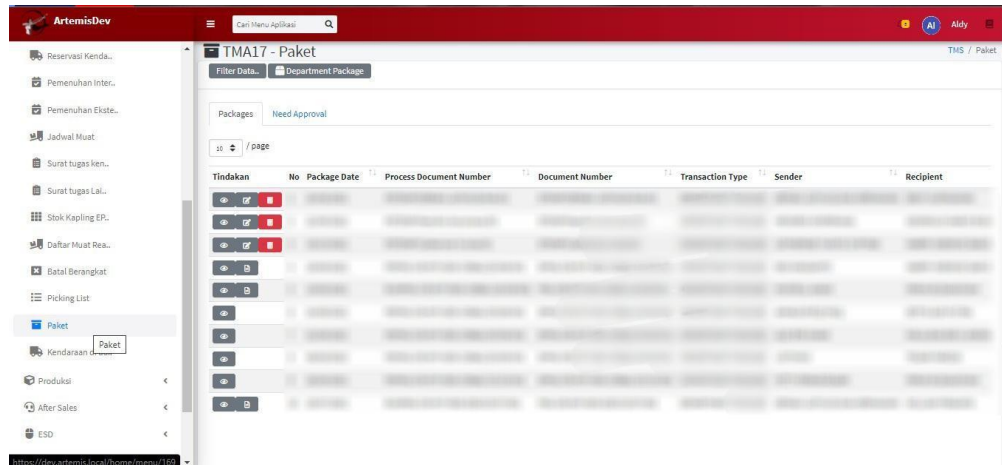
Figure 1. Flowchart

The flowchart above describes the author's workflow at PT. Hartono Istana Teknologi, the first thing to do is read the concept on the tdp when the system is finished and will be tested. After reading the concept, what is done is to create a trial scenario to make it easier to carry out testing. Then after making a trial scenario, proceed with doing a trial program. When doing a trial, if it is found that there is an error function, then write an error note and give it to the ESD. If it is in accordance with the concept, then do a re-trial and if there are no errors in the function then it is finished.

IMPLEMENTATION AND RESULTS

Implementation

Figure 1 is the UI of the system being tested using the Black Box Testing method with the Equivalence Partitioning technique. Black box testing is carried out to test the functionality of the system carried out on the buttons on the system to be tested to determine the function of these buttons and also to test some of the logic functions that are run on the system to be able to adapt to the concepts that have been created. Testing using the Equivalence Partitioning technique is also carried out to assist in system testing, namely by making a test case that contains a list of tests that will be carried out so that they can be carried out properly and in accordance with the order in the concept.



This test focuses on the Package Menu and on the Department Packages section. This test is carried out 5 times to ensure that the system functions are not wrong or missed. By repeating the test 5 times, it can be ascertained that the results obtained must be precise and accurate.

Results

After testing using the Black Box Testing method with the Equivalence Partitioning technique on a set of test cases that have been made, the following results are obtained:

1. In the test case test part A there are 30 test cases and the successful test results are 93%. Testing part A contains all the key functions and logic that exist in the system and testing is done using the Equivalence Partitioning technique.
2. In the Test Form New part B there are 18 test cases and the test results are 100% successful. This part B test contains all the functions on the New Form.
3. In the Test part C, there are some missing data which not shown at the form edit as the data on the sender is empty, which must be filled in and matched when adding a new one. Therefore in test case test part c the success rate is 50% because only has 2 test case in form edit.

Benchmark and Comparison

The benchmark used in this test so that it can be used as the basis for the truth of a test being carried out is the concept being tested. The concept becomes a benchmark because it becomes a reference in a system that is made. In this concept there are several examples that the author takes as follows:

Action :

1 **Data Filter**

Saat click filter, maka muncul input filter data

Package Date	<input type="text"/>	to	<input type="text"/>
Process Document Number	<input type="text"/>	to	<input type="text"/>
Document Number	<input type="text"/>	to	<input type="text"/>
Expedition Type	<input type="text"/>	to	<input type="text"/>
Delivery Type	<input type="text"/>	to	<input type="text"/>
Package Category	<input type="text"/>	to	<input type="text"/>
Recipient	<input type="text"/>	to	<input type="text"/>
Status	ALL <input type="checkbox"/>		

Search

Validasi :

1 Jika field mandatory tidak diisi, maka muncul error message

Delivery Time *
Please fill out this field

Action :

a. **Back**

Kembali ke main display program

b. **Save**

Validasi data sama seperti saat input New data

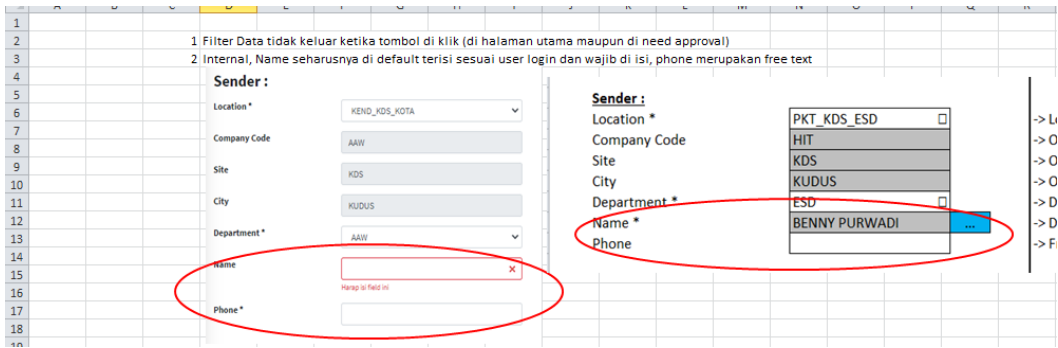
Jika tidak ada error program, maka update data di tabel packages

Selesai update data, maka muncul message berhasil diedit

Data has been successfully edited

refresh data tabel

Comparison is used to compare the methods before and after using the Black Box Testing method with the Equivalence Partitioning technique. The comparison used is the result of a trial from the author who still uses the manual method and also only records if there are program or function errors, while the Black Box Testing method with the Equivalence Partitioning technique is carried out by making a test case that contains the concept of the system to be tested. So that it can be found a significant difference where before using the Black Box Testing method with the Equivalence Partitioning technique it is arguably less specific because there are no records of success for correct program functions and only notes for programs that still have errors. Here are the test results from the author before using the Black Box Testing Method with the Equivalence Partitioning technique.



The picture above is the result of testing by manual method where manual testing is less specific because it does not record all the concepts to be tested, only records when there are errors. The notes on the manual test are intended to be given to the ESD team so that the ESD team can revise and match the concept. Therefore, the test results using this manual method will later be used to compare the test results using the Black Box Testing method with the Equivalence Partitioning technique.

No	Deskripsi Pengujian	Hasil yang diharapkan	Hasil Pengujian
A 01	Saat klik tombol Filter Data, maka akan muncul input Filter Data	Muncul Input Filter Data	Filter Data tidak muncul
A 02	Saat klik tombol Need Approval, maka akan bergeser ke table Need Approval	Berganti ke table Need Approval dari yang sebelumnya table Packages	Berganti ke table Need Approval dari yang sebelumnya table Packages

Figure 10. Sample Test Results After Using Black Box Testing Method With Equivalence Partitioning Technique

The picture above is the result of testing using the Black Box Testing method with the Equivalence Partitioning technique using a test case that contains all the functions in the Package Program. Testing is carried out based on the existing concept, namely what is tested, how the results are based on the concept, and the results of the tests that have been carried out. The test results show that the test is carried out according to the concept and records all functions and logic that are running, whether they are true or false.

Binary Classification

Test Case Part A

Table 2. Table Matrix Test Case Part A

		Predicted	
		Positive	Negative
Actual	Positive	140	0
	Negative	10	0

$$Recall = \frac{TP}{TP + FN} = \frac{140}{140 + 0} = 1 \quad (1)$$

$$Precision = \frac{TP}{TP + FP} = \frac{140}{140 + 10} = 0.93 \quad (2)$$

$$F1 = 2 \cdot \frac{Precision \cdot Recall}{Precision + Recall} = 2 \cdot \frac{0.93 \cdot 1}{0.93 + 1} = 0.96 \quad (3)$$

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} = \frac{140 + 0}{140 + 0 + 10 + 0} = 0.93 \quad (4)$$

In the Test Case Part A test there are 30 test cases where 140 test cases are True Positive (TP), there is no False Negative (FN), and 10 test cases are False Positive (FP), then the result of Recall is 1, and the result of Precision is 0,93. The result of F1 is $0,96 = 0,96$.

Test Case Part B

Table 3. Table Matrix Test Case Part B

		Predicted	
		Positive	Negative
Actual	Positive	90	0
	Negative	0	0

$$Recall = \frac{TP}{TP + FN} = \frac{90}{90 + 0} = 1 \quad (5)$$

$$Precision = \frac{TP}{TP + FP} = \frac{90}{90 + 0} = 1 \quad (6)$$

$$F1 = 2 \cdot \frac{Precision \cdot Recall}{Precision + Recall} = 2 \cdot \frac{1 \cdot 1}{1 + 1} = 1 \quad (7)$$

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} = \frac{90 + 0}{90 + 0 + 90 + 0} = 1 \quad (8)$$

In the Test Case Part B test there are 18 test cases where 18 test cases are True Positive (TP), there is no False Negative (FN), and there is no False Positive (FP), then the result of Recall is 1, and the result of Precision is 1. The result of F1 is $1 = 1$.

Test Case Part C

Table 4. Table Matrix Test Case Part C

		Predicted	
		Positive	Negative
Actual	Positive	5	0
	Negative	5	0

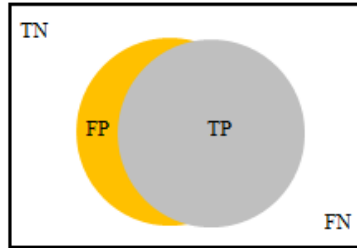
$$Recall = \frac{TP}{TP + FN} = \frac{5}{5 + 0} = 1 \quad (9)$$

$$Precision = \frac{TP}{TP + FP} = \frac{5}{5 + 5} = 0.5 \quad (10)$$

$$F1 = 2 \cdot \frac{Precision \cdot Recall}{Precision + Recall} = 2 \cdot \frac{0.5 \cdot 1}{0.5 + 1} = 0.66 \quad (11)$$

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} = \frac{5 + 0}{5 + 0 + 5 + 0} = 0.5 \quad (12)$$

In the Test Case Part C test there are 2 test cases where 1 test case is True Positive (TP), there is no False Negative (FN), and 1 test case is False Positive (FP), then the result of Recall is 1, and the result of Precision is 0,5. The result of F1 is $0,66 = 0,66$.



At this stage, the calculation results from Recall as much as 100% and Precision 81% with True Positive results as much as 235, True Negative 0, False Positive 15, and False Negative 0. These calculations were obtained from testing 3 part test cases. The results obtained indicate that this test is included in High Recall High Precision, High Precision because it prefers the occurrence of True Positives and really does not want the occurrence of False Positives and for High Recalls because it prefers the occurrence of False Positives rather than the occurrence of False Negatives. Then the tendency of this test tends to be Recall because the results obtained from Recall are 100% for the 3 parts that have been tested compared to the results from Precision which get 81%.

CONCLUSION

The Black Box Testing method with the Equivalence Partitioning technique used in this test can be said to be successful with a success rate of 94%. The success rate is obtained from the results of the test case calculation, from a total of 50 test cases and 46 of them are in accordance with the given concept. Therefore, this test can replace the previous problem which is still less specific than the results obtained. Testing using the Black Box Testing method with the Equivalence Partitioning technique can also be carried out on other system tests because it tests the functionality of the system without looking at the program code and uses test cases as a way to test it.

Manual testing and testing uses the Black Box Testing method with the Equivalence Partitioning technique is carried out based on the concept. However, there are differences in the results obtained where manual testing only writes if there are errors and those using the Black Box Testing method with the Equivalence Partitioning technique write down all existing functions and logic and the results can be seen that something is wrong. or true. The results obtained when testing both manual testing and using the Black Box Testing method with the Equivalence Partitioning technique there are no differences in test results because the results obtained are the same when there is an error, it's just that during manual testing there is no recording when the test results are correct.

Suggestions for further research can use other methods or techniques in testing functionality in the same or different cases. In this test using the Black Box Testing method, so that in the future it can use the White Box Testing method which tests its internal structure. can also use other

techniques, using Boundary Value Analysis, Fuzzing, and others. The author hopes that further research can test the system with several methods or techniques used.

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