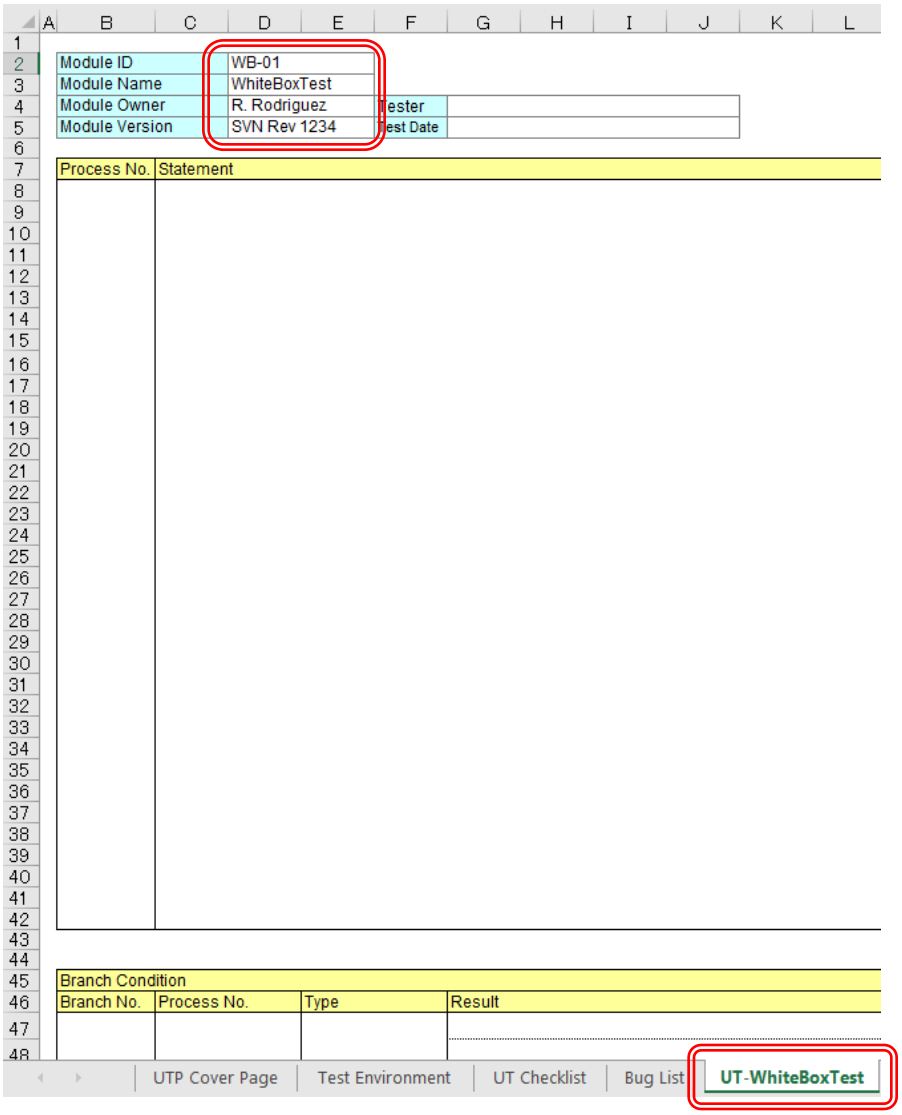
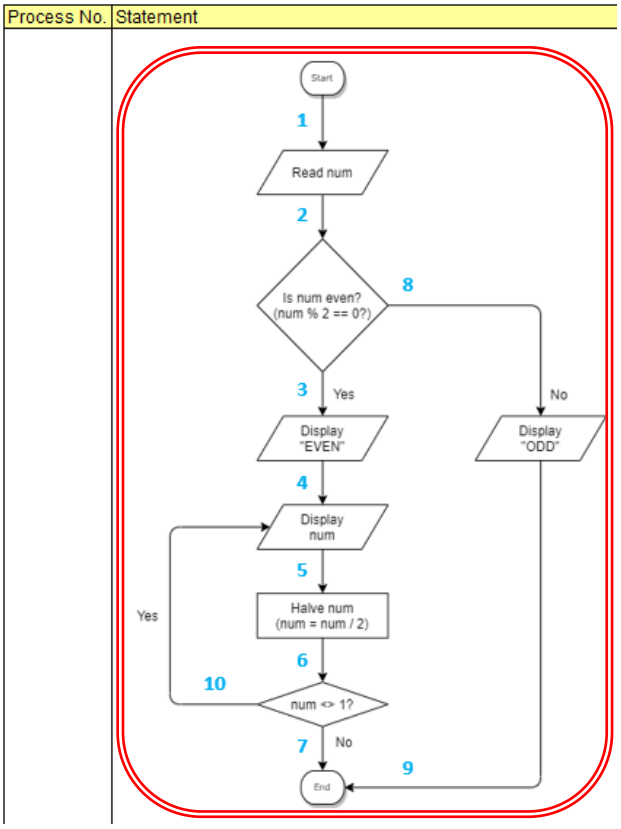
I. UTP Based from Detailed Design

1. The last sheet of the UTP Template (**UT-SampleModule** sheet) is the main sheet where test cases related to one component/method/module/flow is to be indicated. Change the sheet name to reflect either the module name or module ID that you will be testing, and indicate the basic info about the module on the header.



2. In the section immediately below the header, insert the flowchart for the component that is targeted for unit testing. Label all conditional and unconditional branches (i.e., all arrows in your flowchart) with process numbers, starting from 1. (There is no standard way for numbering, but you may choose to sequentially label numbers for one path first before assigning process numbers for the other alternate paths in the flowchart.)



3. Identify all the portions of the flowchart which have several decision outcomes. In our example, process numbers 2 and 6 point to decision symbols (IF statements), so these items become B1 and B2 in the "Branch Condition" table. We enumerate the possible decision outcomes/results for each of these items, so we indicate the labels "Yes" and "No" items for each Branch No.

Branch Condition			
Branch No.	Process No.	Type	Result
B1	2	IF	Yes
			No
B2	6	IF	Yes
			No

Note: LOOP constructs should also be indicated in the "Branch Condition" table if it is present in the flowchart.

4. Enumerate all process numbers as columns in the “Flow” table. Indicate the branch numbers on the process numbers it is related to. Indicate also an additional column for “End”.

   Indicate each possible path from start to end of your flowchart as one flow entry in the “Flow” table. For process numbers which are not tagged with branch numbers, indicate an “O” if the path is expected to execute that process; and indicate “-“ if the path will not execute the process. For process numbers which are also tagged as branch numbers, indicate the decision outcome that the path takes when it is executed.

   In the example, there are 3 possible paths that could be traced: F1 flows straight down from start to end, F2 takes the alternate route on B1, and; F3 takes the alternate route on B2. These 3 flows are indicated in the “Flow” table as shown below.

Flow											
Process No.	1	2	3	4	5	6	7	8	9	10	End
Branch No.	-	B1	-	-	-	B2	-	-	-	-	-
F1	O	Yes	O	O	O	No	O	-	-	-	O
F2	O	No	-	-	-	-	-	O	O	-	O
F3	O	Yes	O	O	O	Yes	-	-	-	O	-
	-	-	-	-	O	No	O	-	-		O

5. After identifying all possible unique paths, you could now choose which flows to consider as test cases for C0/C1 white-box testing. Note that you do not need to test all identified paths – just choose a minimum number of paths which would maximize C0 and C1 coverage. (Target is to achieve C0 coverage ≥ 90%, and C1 coverage ≥ 85%.)

   In the example, F1 and F3 follow nearly similar path, except that F3 has more coverage, because it loops back to process number 5 at least once before it ends. Between the two, we could select F3 as one test case, which will give us:

Flow											
Process No.	1	2	3	4	5	6	7	8	9	10	End
Branch No.	-	B1	-	-	-	B2	-	-	-	-	-
F1	O	Yes	O	O	O	No	O	-	-	-	O
F2	O	No	-	-	-	-	-	O	O	-	O
F3	O	Yes	O	O	O	Yes	-	-	-	O	-
	-	-	-	-	O	No	O	-	-		O

   C0 coverage = 8 process numbers executed at least once ÷ 10 process numbers = 80%

   C1 coverage = 3 decision outcomes ÷ 4 decision outcomes = 75%

   (The “No” decision outcome for B1 is not yet executed if only F3 is selected as test case.)

   Since we still have not achieved the target C0 and C1 coverage, we select another flow to include as a test case. If we also select F2, we would now have:

Flow											
Process No.	1	2	3	4	5	6	7	8	9	10	End
Branch No.	-	B1	-	-	-	B2	-	-	-	-	-
F1	O	Yes	O	O	O	No	O	-	-	-	O
F2	O	No	-	-	-	-	-	O	O	-	O
F3	O	Yes	O	O	O	Yes	-	-	-	O	-
	-	-	-	-	O	No	O	-	-		O

C0 coverage = 10 process numbers executed at least once ÷ 10 process numbers = 100%

C1 coverage = 4 decision outcomes ÷ 4 decision outcomes = 100%

Indicate the selected flows as test item for C0/C1 Test Coverage, and describe the items that should be observed/checked by the tester as expected output when executing the flow in the "Expected Output" column.

Item #	Test Item	Test Cases	Expected Output	Actual Output	Result	Date	
Test Case ID Number	Specific Item to test	Description as to exactly what the tester will be doing	Expected Output (on screen, file/DB, etc.)	Specify actual output	OK/ NG/ NT	Date Completed	To be check
WB001	F3	C0/C1 Test Coverage	1) Displays "EVEN" 2) Displays the original value of num and the halved numbers which are still divisible by 2				
WB002	F2	C0/C1 Test Coverage	1) Displays "ODD"				
		** End of table marker. Do not delete! **					

6. After filling out the test plan, edit the contents of the "UTP Cover Page". This sheet should contain hyperlinks of all the test sheets available in the spreadsheet file. (If you are testing more than one flowchart/method for the same project, you need to manually add those as separate test sheets in the same spreadsheet file.)

Project Name	WhiteBoxTest		
Module ID	WB-01	Module Name	WhiteBoxTest
Created by	R. Rodriguez	Date	Mar 01, 2020
Executed by		Date	

Test Plan	Test Plan Stages			
	Author	Reviewer	Tester	TOTAL
Sheet 1: C0/C1 Unit Testing for WhiteBoxTest	R. Rodriguez Mar 01, 2020			2
				2

7. In the “Test Environment” sheet, indicate the details for the hardware/software requirements needed to execute the tests.

Project Name	WhiteBoxTest

HARDWARE/SOFTWARE SETUP

Test PC: Hardware	
CPU	Intel Core i5
Memory	8.00 GB
HDD Space	500 GB

Test PC: Software	
OS	Windows 10
Language	English
Compiler	JavaSE-9

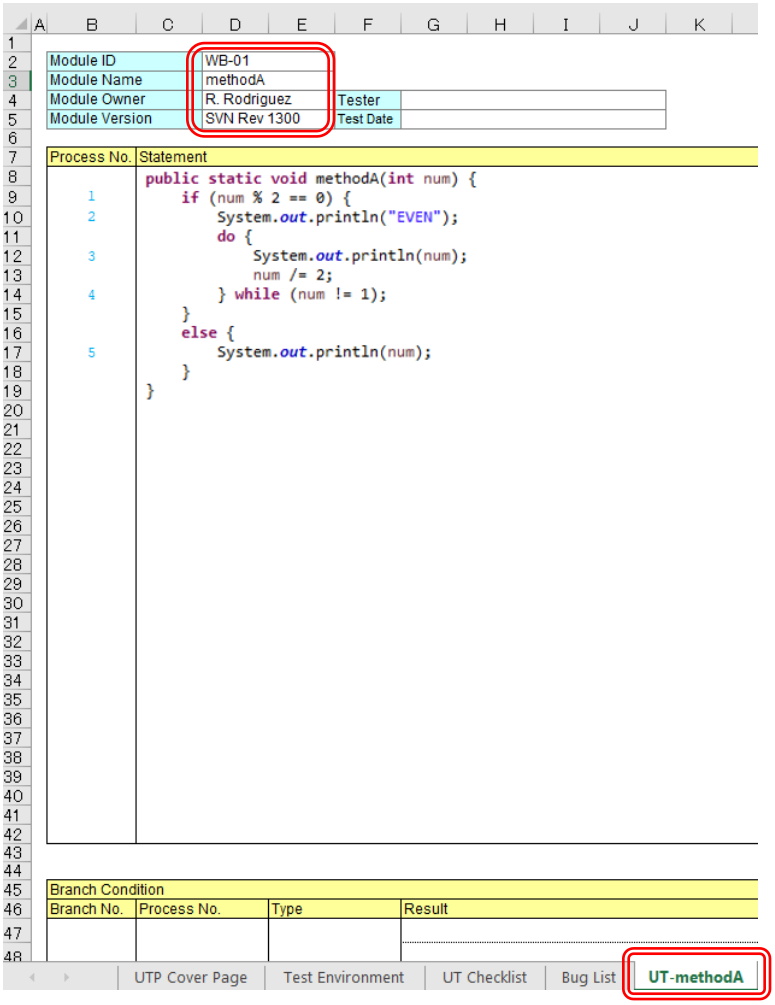
8. Finally, perform a self-review or peer review by going through all check items indicated in the “UT Checklist”. Correct the document as needed in order for all check items to be evaluated as a “PASS” (or have a valid reason for being evaluated as an “N/A”). This should be accomplished before proceeding to a formal review with your test lead.

Unit Test Checklist

Statement and Decision Coverage Testing	**Status**	**Reviewer**	**Review Date**
Labeling the Flowchart or Code			
- Is the correct version/SVN revision of the flowchart or code used for test analysis and design?	PASS	M.A. Mateo	Mar 02, 2020
- Are all the branches/edges in each flowchart labeled with process numbers?	PASS	M.A. Mateo	Mar 02, 2020
- Are all the sequential, conditional and repetition constructs appropriately labeled with process numbers?	N/A	M.A. Mateo	Mar 02, 2020
* Sequential statements are labeled only with 1 process number.			
* For IF statements, indicate a process number on every IF.			
* For SWITCH statements, indicate a process number on every CASE, inclusive of the DEFAULT.			
* For the repetition constructs (FOR, WHILE, DO-WHILE), indicate a process number where the guard condition is located.			
* Indicate a process number on each CATCH clause, and on the FINALLY clause.			
Branch Identification			
- Have all the conditional branches from the flowchart/code been identified and listed?	PASS	M.A. Mateo	Mar 02, 2020
- Is the associated process number indicated for each branch the correct process number?	PASS	M.A. Mateo	Mar 02, 2020
* If based from flowcharts, the process number should be the number of the incoming edge to the decision symbol.			
* If based from codes, the process number should be the number on the IF/1st CASE/FOR/WHILE/WHILE of DO-WHILE.			
- Are all the branches identified with the correct type/keyword?	PASS	M.A. Mateo	Mar 02, 2020
- Are all the result labels consistent with the labels used in the flowchart/source code?	PASS	M.A. Mateo	Mar 02, 2020
* If based from flowcharts, the keyword should match the label for the branches of the particular decision symbol.			
* If based from source codes, the result is either "True"/"False", or the keyword for every CASE + DEFAULT.			
Flow/Path Enumeration			
- Have all the process numbers, branch numbers and the "End" keyword indicated as labels for the appropriate columns in the table?	PASS	M.A. Mateo	Mar 02, 2020
- Does each flow entry represent a unique path on the flowchart/code?	PASS	M.A. Mateo	Mar 02, 2020
Test Case Selection			
- When collating all the flows selected as test cases, is C0 Coverage >= 90% and C1 Coverage >= 85%?	PASS	M.A. Mateo	Mar 02, 2020
* >= 90% of the process numbers have been exercised at least once.			
* >= 85% of the branches have its possible results exercised at least once.			

II. **UTP Based from Source Code**

1. The last sheet of the UTP Template (**UT-SampleModule** sheet) is the main sheet where test cases related to one component/method/module/flow is to be indicated. Change the sheet name to reflect either the module name or module ID that you will be testing, and indicate the basic info about the method on the header.



2. In the section immediately below the header, insert the source code for the method that is targeted for unit testing. The process numbers are not the line numbers in your source code. Instead, the numbering follows these rules:

   a) Sequential statements are labeled only with 1 process number.
   Example: "`System.out.println(num);`" and "`num /= 2;`" are tagged as process number 3.

   b) For IF statements, indicate a process number on every IF.
   Example: "if (num % 2 == 0) { " is tagged as process number 1. Note: the "else" is not tagged with a different process number because it is a decision outcome for process

number 1 (if num % 2 == 0 is false). However, the statement inside the else should be marked as a separate process number.

c) For SWITCH statements, indicate a process number on every CASE. Indicate also a separate process number on the DEFAULT clause.

d) For the repetition constructs (FOR, WHILE, DO-WHILE), indicate a process number where the guard condition is located. Example: In the do-while loop above, the process number is not indicated on "`do {`" but on the "`} while (num != 1);`".

e) For TRY-CATCH-FINALLY blocks, indicate a process number on each CATCH clause, and on the FINALLY clause.

3. Identify all the portions of the code which have several decision outcomes. In our example, process numbers 1 (IF statement) and 4 (DO-WHILE statement) point to parts of the code which have guard conditions, so these items become B1 and B2 in the "Branch Condition" table. We enumerate the possible decision outcomes/results for each of these items, so we indicate the labels "True" and "False" items for each Branch No.

Branch Condition			
Branch No.	Process No.	Type	Result
B1	1	IF	True
			False
B2	4	DO-WHILE	True
			False

4. Enumerate all process numbers as columns in the "Flow" table. Indicate the branch numbers on the process numbers it is related to. Indicate also an additional column for "End".

   Indicate each possible path from start to end of your method as one flow entry in the "Flow" table. For process numbers which are not tagged with branch numbers, indicate an "O" if the path is expected to execute that process; and indicate "-" if the path will not execute the process. For process numbers which are also tagged as branch numbers, indicate the decision outcome that the path takes when it is executed.

Flow						
Process No.	1	2	3	4	5	End
Branch No.	B1	-	-	B2	-	-
F1	True	O	O	True	-	-
	-	-	O	False	-	O
F2	False	-	-	-	O	O

5. After identifying all possible unique paths, you could now choose which flows to consider as test cases for C0/C1 white-box testing. Note that you do not need to test all identified paths – just choose a minimum number of paths which would maximize C0 and C1 coverage. (Target is to achieve C0 coverage ≥ 90%, and C1 coverage ≥ 85%.)

   In the example, if we only select F1, we have:

Flow						
Process No.	1	2	3	4	5	End
Branch No.	B1	-	-	B2	-	-
F1	True	O	O	True	-	-
	-	-	O	False	-	O
F2	False	-	-	-	O	O

   C0 coverage = 4 process numbers executed at least once ÷ 5 process numbers = 80%

   C1 coverage = 3 decision outcomes ÷ 4 decision outcomes = 75%

   (The "False" decision outcome for B1 is not yet executed if only F1 is selected as test case.)

   Since we still have not achieved the target C0 and C1 coverage, we select another flow to include as a test case. If we also select F2, we would now have:

Flow						
Process No.	1	2	3	4	5	End
Branch No.	B1	-	-	B2	-	-
F1	True	O	O	True	-	-
	-	-	O	False	-	O
F2	False	-	-	-	O	O

   C0 coverage = 5 process numbers executed at least once ÷ 5 process numbers = 100%

   C1 coverage = 4 decision outcomes ÷ 4 decision outcomes = 100%

   Indicate the selected flows as test item for C0/C1 Test Coverage, and describe the items that should be observed/checked by the tester as expected output when executing the flow in the "Expected Output" column.

Item #	Test Item	Test Cases	Expected Output	Actual Output	Result	Date	
Test Case ID Number	Specific Item to test	Description as to exactly what the tester will be doing	Expected Output (on screen, file/DB, etc.)	Specify actual output	OK/ NG/ NT	Date Completed	To be check
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		** End of table marker. Do not delete! **					

6. After filling out the test plan, edit the contents of the “UTP Cover Page”. This sheet should contain hyperlinks of all the test sheets available in the spreadsheet file. (If you are testing more than one method for the same project, you need to manually add those as separate test sheets in the same spreadsheet file.)

Project Name	WhiteBoxTest		
Module ID	WB-01	Module Name	methodA
Created by	R. Rodriguez	Date	Mar 01, 2020
Executed by		Date	

Test Plan	Test Plan Stages			
	Author	Reviewer	Tester	TOTAL
Sheet 1: C0/C1 Unit Testing for methodA	R. Rodriguez Mar 01, 2020	M.A. Mateo Mar 02, 2020		2
				2

7. In the “Test Environment” sheet, indicate the details for the hardware/software requirements needed to execute the tests.

Project Name	WhiteBoxTest

HARDWARE/SOFTWARE SETUP

Test PC: Hardware	
CPU	Intel Core i5
Memory	8.00 GB
HDD Space	500 GB

Test PC: Software	
OS	Windows 10
Language	English
Compiler	JavaSE-9

8. Finally, perform a self-review or peer review by going through all check items indicated in the “UT Checklist”. Correct the document as needed in order for all check items to be evaluated as a “PASS” (or have a valid reason for being evaluated as an “N/A”). This should be accomplished before proceeding to a formal review with your test lead.

Unit Test Checklist

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Labeling the Flowchart or Code			
- Is the correct version/SVN revision of the flowchart or code used for test analysis and design?	PASS	M.A. Mateo	Mar 02, 2020
- Are all the branches/edges in each flowchart labeled with process numbers?	N/A	M.A. Mateo	Mar 02, 2020
- Are all the sequential, conditional and repetition constructs appropriately labeled with process numbers?	PASS	M.A. Mateo	Mar 02, 2020
* Sequential statements are labeled only with 1 process number.			
* For IF statements, indicate a process number on every IF.			
* For SWITCH statements, indicate a process number on every CASE, inclusive of the DEFAULT.			
* For the repetition constructs (FOR, WHILE, DO-WHILE), indicate a process number where the guard condition is located.			
* Indicate a process number on each CATCH clause, and on the FINALLY clause.			
Branch Identification			
- Have all the conditional branches from the flowchart/code been identified and listed?	PASS	M.A. Mateo	Mar 02, 2020
- Is the associated process number indicated for each branch the correct process number?	PASS	M.A. Mateo	Mar 02, 2020
* If based from flowcharts, the process number should be the number of the incoming edge to the decision symbol.			
* If based from codes, the process number should be the number on the IF/1st CASE/FOR/WHILE/WHILE of DO-WHILE.			
- Are all the branches identified with the correct type/keyword?	PASS	M.A. Mateo	Mar 02, 2020
- Are all the result labels consistent with the labels used in the flowchart/source code?	PASS	M.A. Mateo	Mar 02, 2020
* If based from flowcharts, the keyword should match the label for the branches of the particular decision symbol.			
* If based from source codes, the result is either "True"/"False", or the keyword for every CASE + DEFAULT.			
Flow/Path Enumeration			
- Have all the process numbers, branch numbers and the "End" keyword indicated as labels for the appropriate columns in the table?	PASS	M.A. Mateo	Mar 02, 2020
- Does each flow entry represent a unique path on the flowchart/code?	PASS	M.A. Mateo	Mar 02, 2020
Test Case Selection			
- When collating all the flows selected as test cases, is C0 Coverage >= 90% and C1 Coverage >= 85%?	PASS	M.A. Mateo	Mar 02, 2020
* >= 90% of the process numbers have been exercised at least once.			
* >= 85% of the branches have its possible results exercised at least once.			