MUTATION TESTING

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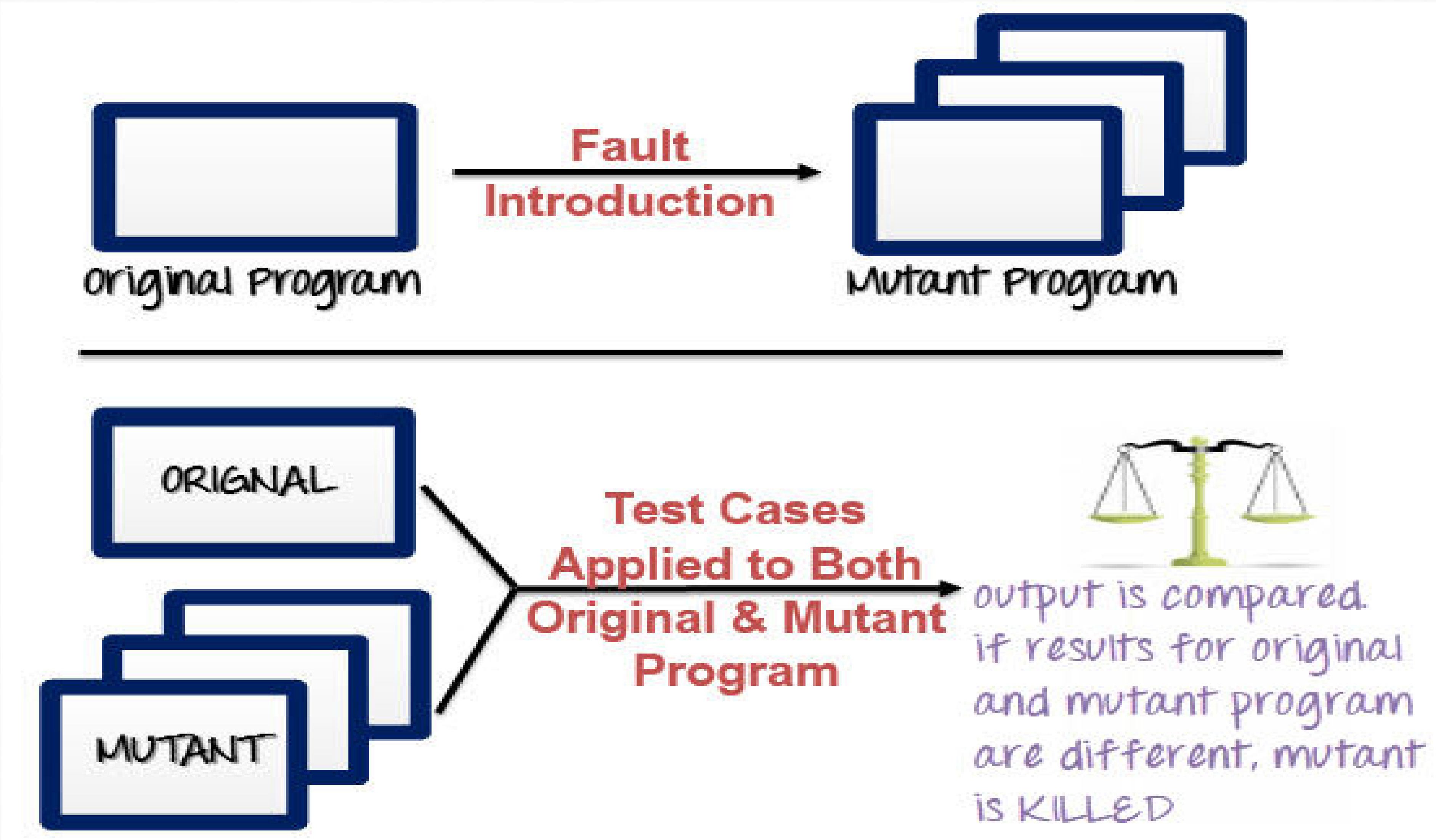
- MUTATION TESTING IS A TYPE OF SOFTWARE TESTING WHERE WE MUTATE (CHANGE) CERTAIN STATEMENTS IN THE SOURCE CODE AND CHECK IF THE TEST CASES ARE ABLE TO FIND THE ERRORS.

- THE CHANGES IN MUTANT PROGRAM ARE KEPT EXTREMELY SMALL, SO IT DOES NOT AFFECT THE OVERALL OBJECTIVE OF THE PROGRAM.



output is compared.
if results for original
and mutant program
are different, mutant
is KILLED

STEPS TO EXECUTE MUTATION TESTING

STEP 1:

- **FAULTS ARE INTRODUCED INTO THE SOURCE CODE OF THE PROGRAM BY CREATING MANY VERSIONS CALLED MUTANTS.**
  - ✓ **EACH MUTANT SHOULD CONTAIN A SINGLE FAULT.**
  - ✓ **THE GOAL IS TO CAUSE THE MUTANT VERSION TO FAIL WHICH DEMONSTRATES THE EFFECTIVENESS OF THE TEST CASES.**

STEPS TO EXECUTE MUTATION TESTING

STEP 2:

- TEST CASES ARE APPLIED TO THE ORIGINAL PROGRAM AND ALSO TO THE MUTANT PROGRAM.
  - A TEST CASE SHOULD BE ADEQUATE, AND IT IS TWEAKED TO DETECT FAULTS IN A PROGRAM.

STEP 3:

- COMPARE THE RESULTS OF ORIGINAL AND MUTANT PROGRAM.

STEPS TO EXECUTE MUTATION TESTING

STEP 4:

- IF THE ORIGINAL PROGRAM AND MUTANT PROGRAMS GENERATE THE DIFFERENT OUTPUT, THEN THAT THE MUTANT IS KILLED BY THE TEST CASE.
- HENCE THE TEST CASE IS GOOD ENOUGH TO DETECT THE CHANGE BETWEEN THE ORIGINAL AND THE MUTANT PROGRAM.

STEPS TO EXECUTE MUTATION TESTING

STEP 5:

- IF THE ORIGINAL PROGRAM AND MUTANT PROGRAM GENERATE SAME OUTPUT, MUTANT IS KEPT ALIVE.
- IN SUCH CASES, MORE EFFECTIVE TEST CASES NEED TO BE CREATED THAT KILL ALL MUTANTS.

Mutant Programs

A MUTATION IS A SINGLE SYNTACTIC CHANGE THAT IS MADE TO THE PROGRAM STATEMENT.

EACH MUTANT PROGRAM SHOULD DIFFER FROM THE ORIGINAL PROGRAM BY ONE MUTATION.

Original Program	**Mutant Program**
If (x>y)	**If(x<y)**
Print "Hello"	**Print "Hello"**
Else	**Else**
Print "Hi"	**Print "Hi"**

SOME OF SAMPLE MUTATION OPERATORS

- GOTO LABEL REPLACEMENT
- RETURN STATEMENT REPLACEMENT
- STATEMENT DELETION
- UNARY OPERATOR INSERTION (LIKE – AND ++)
- LOGICAL CONNECTOR REPLACEMENT
- COMPARABLE ARRAY
- NAME REPLACEMENT
- REMOVING OF ELSE PART IN THE IF-ELSE STATEMENT
- ADDING OR REPLACEMENT OF OPERATORS
- STATEMENT REPLACEMENT BY CHANGING THE DATA
- DATA MODIFICATION FOR THE VARIABLES
- MODIFICATION OF DATA TYPES IN THE PROGRAM

TYPES OF MUTATION TESTING

STATEMENT MUTATION:

DEVELOPER CUT AND PASTES A PART OF CODE OF WHICH THE OUTCOME MAY BE REMOVAL OF SOME LINES.

VALUE MUTATION:

VALUES OF PRIMARY PARAMETERS ARE MODIFIED.

DECISION MUTATION:

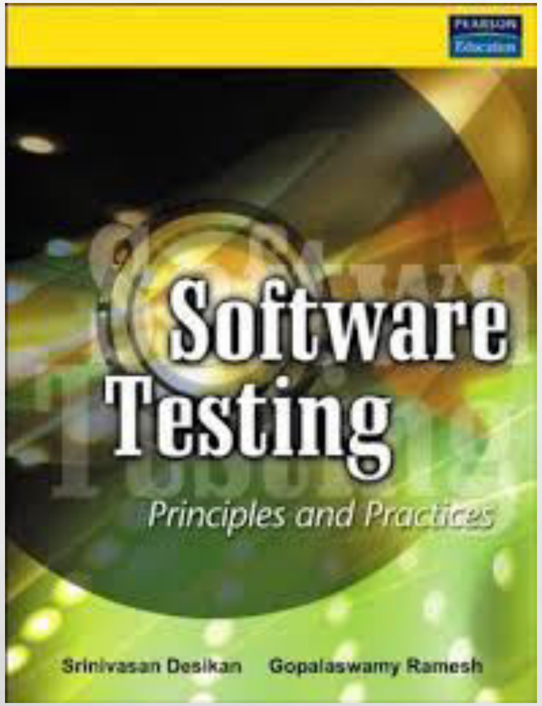
CONTROL STATEMENTS ARE TO BE CHANGED.

MUTATION SCORE

THE MUTATION SCORE IS DEFINED AS THE PERCENTAGE OF KILLED MUTANTS WITH THE TOTAL NUMBER OF MUTANTS.

MUTATION SCORE = (KILLED MUTANTS / TOTAL NUMBER OF MUTANTS) * 100

REFERENCES



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edureka!

Software Testing Help