Specification Based Testing – Part 2
Metamorphic Testing

Objective

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Understand Metamorphic Testing

Test Oracle Problem

For many applications it is difficult to determine the expected results

- Graphics applications
- Complex processing
- Machine Learning
- Big Data

Fuzz testing can be used to detect crashes
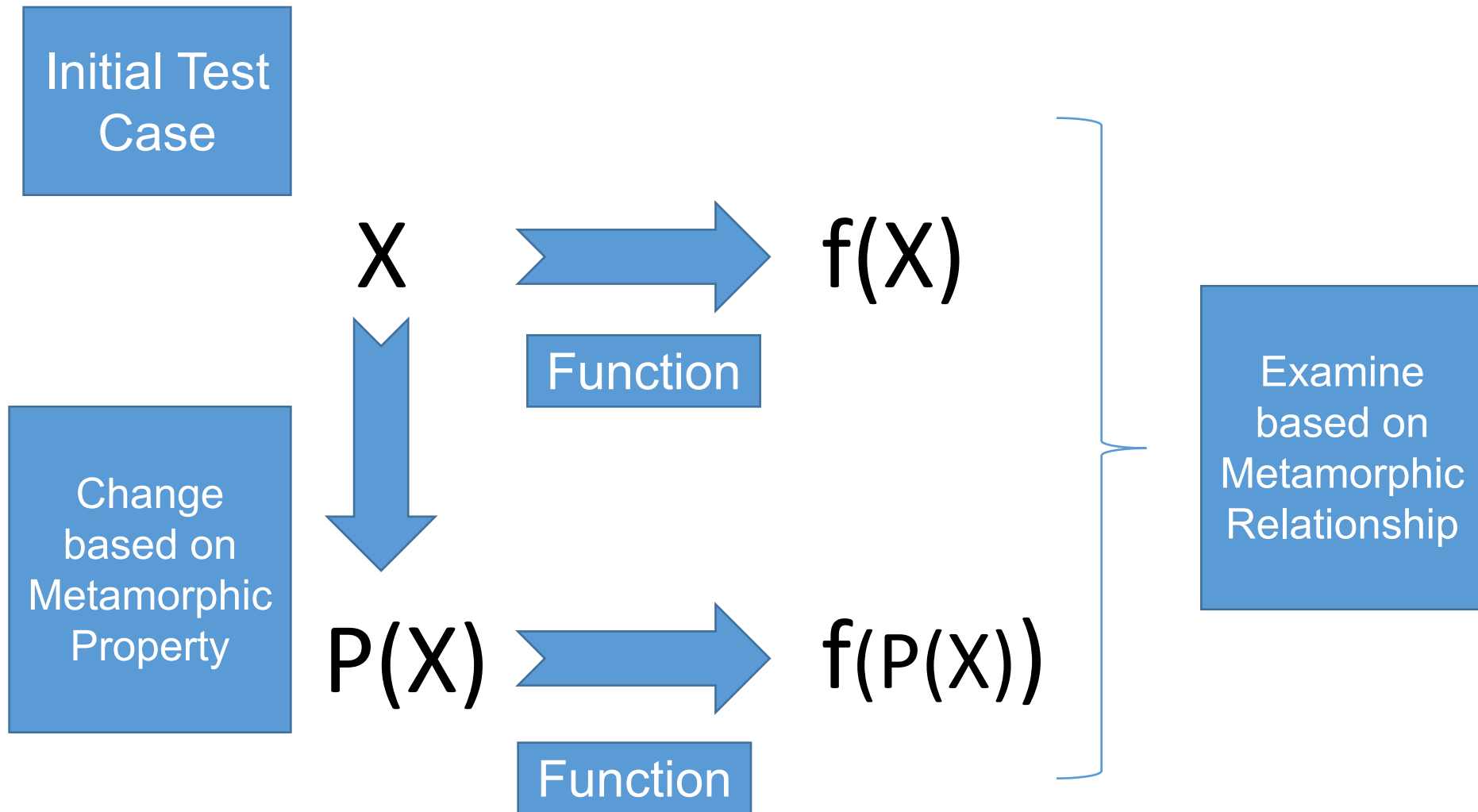
Metamorphic testing can assist

Assumptions

Some programs have properties such that when changes are made to inputs it is possible to predict changes on outputs (metamorphic properties)

Consider a service that calculates the variance of a sequence of numbers

- What is the relationship of changing the order?
- What is the relationship of adding 10 to teach number?

Metamorphic Testing

Initial Test Case

X → f(X)

Function

Change based on Metamorphic Property

P(X) → f(P(X))

Function

Examine based on Metamorphic Relationship

Standard Deviation Example

Initial Test: 10, 20, 30, 40, 50

- Result: 14.142

Second Test: 20, 30, 40, 50, 60

- Result: 14.142

Third Test: 10, 30, 50, 70, 90

- Result: 28.284

Summary