

## 1. Syntax-based testing (Grammar)

Consider the following BNF:

```
Y ::= W S F | S M F | S M
```

```
W ::= "d" | "j" | "f"
```

```
S ::= "m" | "a" | "y"
```

```
M ::= "y" | "n" | "u" | "g"
```

```
F ::= "p" | "o" | "n"
```

1.1 Write two strings that are valid according to the BNF.

1) "dmp"

2) "jap"

1.2 For each of your two strings, give two **valid mutants** of the string.

1) "jmp"

2) "dap"

Changed the first letter in both strings to another letter in *W*

1.3 For each of your two strings, give two **invalid mutants** of the string.

1) "amp"

2) "yap"

For both of these strings, changed the first letter to a letter that was not in *W*

## 2. Syntax-based testing (Program)

Consider the Min method and six mutants (Figure 9.1 from textbook)

Original Method	With Embedded Mutants
<pre>int Min(int A, int B) {     int minVal;     minVal = A;     if (B &lt; A)     {         minVal = B;     }     return (minVal); }</pre>	<pre>int Min(int A, int B) {     int minVal;     minVal = A;     △1 minVal = B;     if (B &lt; A)     △2 if (B &gt; A)     △3 if (B &lt; minVal)     {         minVal = B;         △4 Bomb();         △5 minVal = A;         △6 minVal = failOnZero(B);     }     return (minVal); }</pre>

Note:

Reachability: the test causes the faulty (mutated) statement to be reached

Infection: the test causes the faulty statement to result in an incorrect state

Propagation: the incorrect state propagates to incorrect output

Revealability: the tester must observe part of the incorrect output

2.1 Provide reachability conditions, infection conditions, propagation conditions, and test case values to kill mutant 2

Reachability: True

Infection:  $A \neq B$

Propagation: Always/True (if reachability and infection conditions are met)

Test case value:  $A = 4$ ,  $B = 3$

2.2 Provide reachability conditions, infection conditions, propagation conditions, and test case values to kill mutant 4

Reachability:  $B < A$

Infection:  $B < A$  (True)

Propagation: Always/True (if reachability and infection conditions are met)

Test case value:  $A = 2$ ,  $B = 1$

2.3 Provide reachability conditions, infection conditions, propagation conditions, and test case values to kill mutant 5

Reachability:  $B < A$

Infection:  $A \neq B$

Propagation: Always/True (if reachability and infection conditions are met)

Test case value:  $A = 2$ ,  $B = 1$

2.4 Provide reachability conditions, infection conditions, propagation conditions, and test case values to kill mutant 6

Reachability:  $B < A$

Infection:  $B == 0$

Propagation:  $B == 0$  (failOnZero() method causes a failure if the B is zero)

Test case value:  $A = 2$ ,  $B = 0$