CS314 Software Engineering
White Box (Coverage) Testing

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Program testing types

• Black-box testing
  – Specifications drive test inputs and expected outputs
  – No code, design or internal documentation are available
• White-box testing
  – Code structure drives test inputs
  – Specification used to derive tests outputs
  – Code, design, and internal documentation are available
  – Goal is to “cover” the code to gain confidence and detect defects.
White Box Testing

• Statement Coverage
  – Requires all statements to be executed

• Branch Coverage
  – Require decisions evaluate to true and false at least once
  – Implies statement coverage

• Path Coverage
  – Require all possible paths to be executed
  – Implies branch coverage

Coverage Problems

• Statement
  – May not exercise all the conditions in predicates

• Branch
  – May not exercise all combinations of branches

• Path
  – combinatorial explosion
  – infinite paths for loops
  – not all paths are feasible
Coverage

• Statements

• Branch

• Path

Statement Coverage

1 double pow (double x, int y) {
2    int p = 0;
3    double z = 1.0;
4    if (y < 0)
5        p = -y;
6    else if (y > 0)
7        p = y;
8
9    while (p-- > 0)
10        z = z * x;
11    if (y < 0)
12        z = 1.0/z;
13    return z;
14 }
Branch Coverage

1 double pow (double x, int y) {
2     int p = 0;
3     double z = 1.0;
4     if (y < 0)
5         p = -y;
6     else if (y > 0)
7         p = y;
8     ; else nothing
9     while (p-- > 0)
10         z = z * x;
11     if (y < 0)
12         z = 1.0/z;
13     return z;
14 }

Path Coverage

1 double pow (double x, int y) {
2     int p = 0;
3     double z = 1.0;
4     if (y < 0)
5         p = -y;
6     else if (y > 0)
7         p = y;
8     ; else nothing
9     while (p-- > 0)
10         z = z * x;
11     if (y < 0)
12         z = 1.0/z;
13     return z;
14 }
Statement Coverage

1 public class Example {
2   public int xmpl( int x, boolean c1, boolean c2, boolean c3) {
3       if (c1)
4           x++;
5       if (c2)
6           x--;
7       if (c3)
8           x = -x;
9       return x;
10    }
11 }

; 2,3,4,5,6,7,8,9
xmpl(9, true, true, true);

Branch Coverage

1 public class Example {
2   public int xmpl( int x, boolean c1, boolean c2, boolean c3) {
3       if (c1)
4           x++;
5       if (c2)
6           x--;
7       if (c3)
8           x = -x;
9       return x;
10    }
11 }

; 3T,5T,7T
xmpl(9, true, true, true);
; 3F,5F,7F
xmpl(7, false, false, false);
Path Coverage

```java
public class Example {
    public int xmpl(int x, boolean c1, boolean c2, boolean c3) {
        if (c1)
            x++;
        if (c2)
            x--;
        if (c3)
            x = -x;
        return x;
    }
}
```

IntelliJ IDEA Coverage

![Coverage Diagram](image)
IntelliJ IDEA Coverage

- [https://www.youtube.com/watch?v=yNYzZvyA2ik](https://www.youtube.com/watch?v=yNYzZvyA2ik)