

Exercise 1

If the pseudocode below were a programming language ,how many tests are required to achieve 100% statement coverage?

```
If x=3 then
    Display_messageX;
    If y=2 then
        Display_messageY;
    Else
        Display_messageZ;
Else
    Display_messageZ;
```

- 1. Choose the correct answer

a) 1; b) 2; c) 3; d) 4

Using the same code example as question 17,how many tests are required to achieve 100% branch/decision coverage?

- 2. Choose the correct answer

a) 1; b) 2; c) 3; d) 4

Exercise 2

- Given the following code, which is true about the minimum number of test cases required for full statement and branch coverage:

```
Read P
Read Q
IF P+Q > 100 THEN
    Print "Large"
ENDIF
If P > 50 THEN
    Print "P Large"
ENDIF
```

- a) 1 test for statement coverage, 3 for branch coverage
- ☒ b) 1 test for statement coverage, 2 for branch coverage
- c) 1 test for statement coverage, 1 for branch coverage
- d) 2 tests for statement coverage, 3 for branch coverage
- e) 2 tests for statement coverage, 2 for branch coverage

Exercise 3 (1)

- A Program is written to meet the following requirements:
 - R1: Given coordinate positions x , y and z , and a direction valued d , the program must invoke one of the three functions fire-1, fire-2, fire-3 as per conditions bellow:
 - R1.1: Invoke fire-1 when $(x < y) \text{ AND } (z * z > y) \text{ AND } (\text{prev} = \text{"East"})$.
 - R1.2: Invoke fire-2 when $(x < y) \text{ AND } (z * z \leq y) \text{ OR } (\text{current} = \text{"South"})$.
 - R1.3: Invoke fire-3 when none of the two conditions above is true.
 - R2: The invocation described above must continue until an input Boolean variable becomes true.

Exercise 3 (2)

```
1 begin
2   float x, y, z;
3   direction d;
4   string prev, current;
5   bool done;

6   input(done);
7   current="North";
8   while (~done) {                                ← condition C1
9       input (d);
10      prev=current; current=f(d);
11      input(x,y,z);
12      if ((x<y) and (z*z > y) and (prev=="East"))    ← Condition C2
13          fire-1(x,y);
14      else if ((x<y) and (z*z<=y) or (current=="South")) ← Condition C3
15          fire-2(x,y);
16      else
17          fire-3(x,y);
17      input(done);
18  }
19  output("Firing completed.");
20 end
```

Exercise 3 (3)

- Verify that the following set T1 of four tests, executed in the given order, is adequate with respect to statement, block, and decision coverage criteria but not with respect to the condition coverage criterion.

Test set T1						
Test	Requirement	done	d	x	y	z
t1	R1.2	False	East	10	15	3
t2	R1.1	False	South	10	15	4
t3	R1.3	False	North	10	15	5
t4	R2	True	-	-	-	-

- C2 and C3 are not covered because $x < y$ is not covered, i.e., it is not evaluated to false

© Aditya P. Mathur 2007

Exercise 3 (4)

Test set T2						
Test	Requirement	done	d	x	y	z
t1	R1.2	False	East	10	15	3
t2	R1.1	False	South	10	15	4
t3	R1.3	False	North	10	15	5
t5	R1.1 and R1.2	False	South	10	5	5
t4	R2	True	-	-	-	-

Test set T2 is adequate according to MC/DC?

In case of C2, we note that conditions $(x < y)$ and $(z * z > y)$ are kept constant in t2 and t3, while $(prev == \text{"East"})$ is varied. These two tests demonstrate the independence effect of $(prev == \text{"East"})$ on C2. However, the independence effect of the remaining two conditions is not demonstrated by T2.

In case of C3, we note that tests t3 and t4, conditions $(z * z \leq y)$ and $(current == \text{"South"})$ are held constant, while $(x < y)$ is varied. These two tests demonstrate the independence effect of $(x < y)$ on C3. Tests t1 and t3 demonstrate the independence effect of $(z * z < y)$ on C3. However, the independence effect of $(current == \text{"South"})$ on C3 is not demonstrated by T2. This analysis reveals that we need to add at least two tests to T2 to obtain MC/DC coverage.

Exercise 3 (5)

- Verify that the following set T3, obtained by adding t6, t7, t8, and t9 to T2 is adequate with respect to MC/DC coverage criterion. **Note** again that sequencing of tests is important in this case (especially for t1 and t7)!

Test set T3						
Test	Requirement	done	d	x	y	z
t1	R1.2	False	East	10	15	3
t6	R1	False	East	10	5	2
t7	R1	False	East	10	15	3
t2	R1.1	False	South	10	15	4
t3	R1.3	False	North	10	15	5
t5	R1.1 and R1.2	False	South	10	5	5
t8	R1	False	South	10	5	2
t9	R1	False	North	10	5	2
t4	R2	True	-	-	-	-

© Aditya P. Mathur 2007

Exercise 4

- Suppose that condition $C = C1 \text{ AND } C2 \text{ AND } C3$ has been coded as $C' = C1 \text{ AND } C3$. Four tests that form an MC/DC adequate set for C' are in the following table. Verify that the following set of four tests is MC/DC adequate but does not reveal the error.

	Test	C	C'	Error detected?
	C1, C2, C3	C1 and C2 and C3	C1 and C3	
t1	true, true, true	true	true	No
t2	false, false, false	false	false	
t3	true, true, false	false	false	No
t4	false, false, true	false	false	