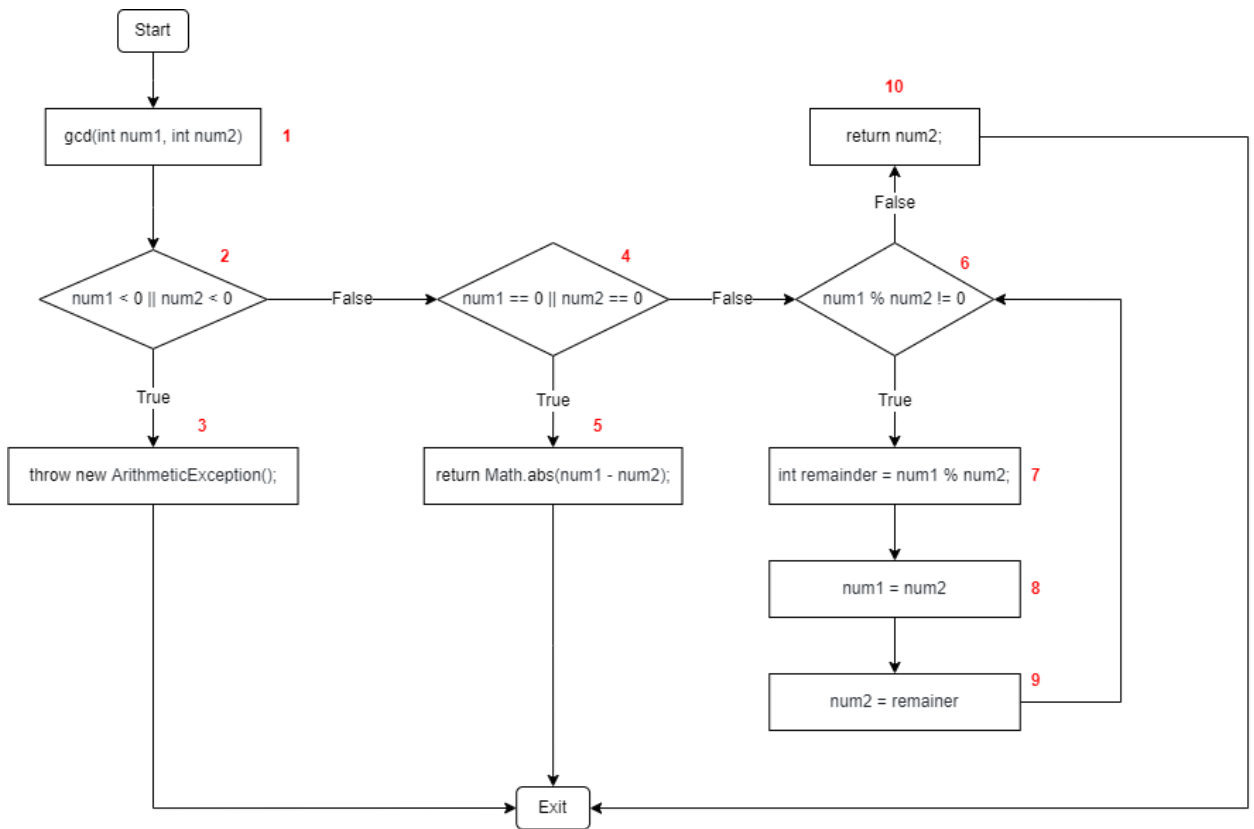


Testing GCD algorithm based on MC/DC

1. Control flow graph



2. Generate paths

- Path 1: 1 → 2T → 3
- Path 2: 1 → 2F → 4T → 5
- Path 3: 1 → 2F → 4F → 6T → 7 → 8 → 9 → 6F → 10

T represents for True condition

F represents for False condition

3. Generate test suite

- Path 1:

$$\left[\begin{array}{l} \{num1 < 0 \\ num2 \geq 0\} \Rightarrow \text{Test case: } \begin{cases} num1 = -1 \\ num2 = 0 \end{cases} \\ \{num1 \geq 0 \\ num2 < 0\} \Rightarrow \text{Test case: } \begin{cases} num1 = 10 \\ num2 = -2 \end{cases} \\ \{num1 < 0 \\ num2 < 0\} \Rightarrow \text{Test case: } \begin{cases} num1 = -5 \\ num2 = -3 \end{cases} \end{array} \right.$$

- Path 2:

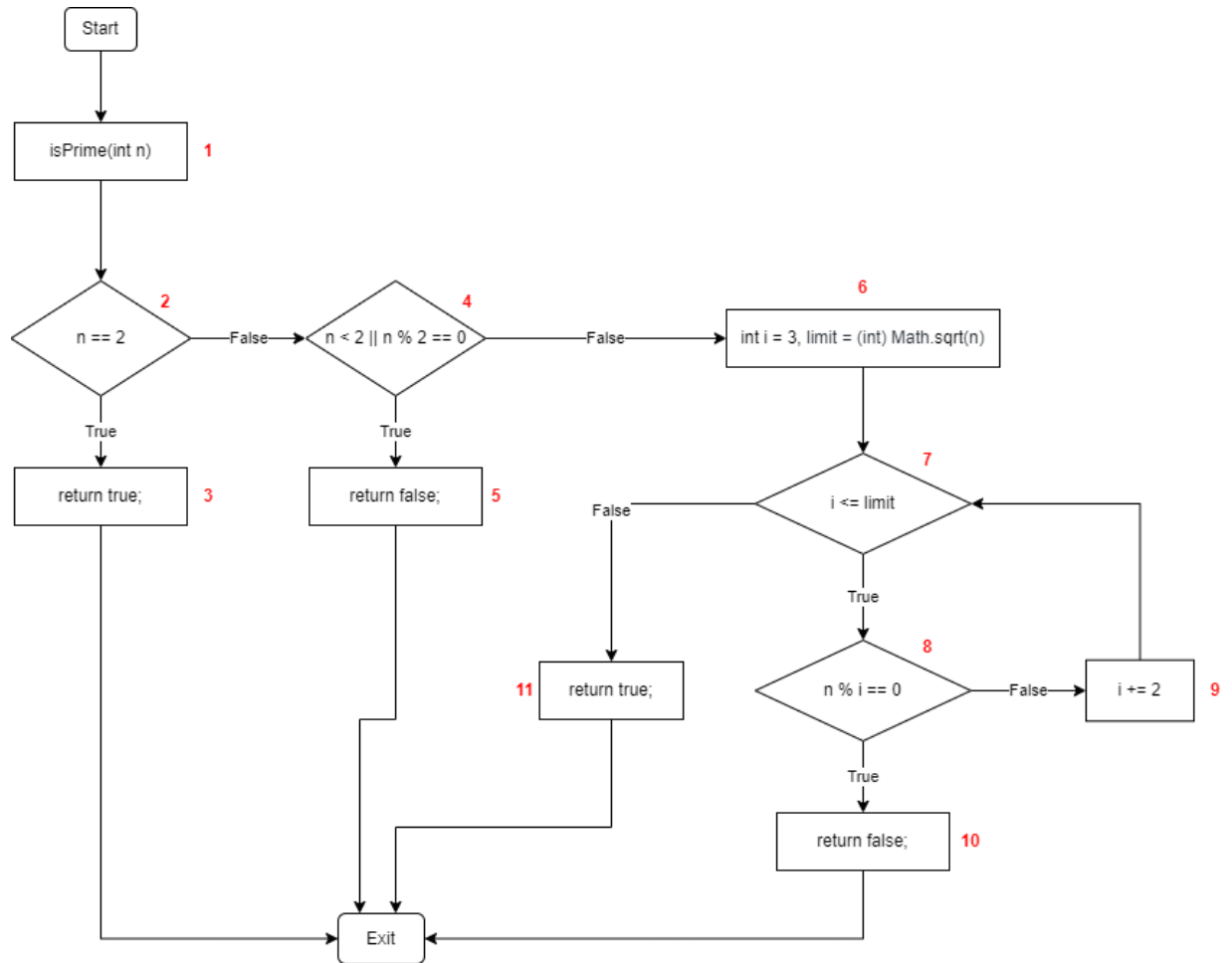
$$\left\{ \begin{array}{l} num1 \geq 0 \\ num2 \geq 0 \\ num1 = 0 \\ num2 = 0 \end{array} \right\} \Rightarrow \left\{ \begin{array}{l} \left\{ \begin{array}{l} num1 \geq 0 \\ num2 \geq 0 \\ num1 = 0 \\ num2 \neq 0 \end{array} \Rightarrow Test\ case: \begin{cases} num1 = 0 \\ num2 = 2 \end{cases} \\ \left\{ \begin{array}{l} num1 \geq 0 \\ num2 \geq 0 \\ num1 \neq 0 \\ num2 = 0 \end{array} \Rightarrow Test\ case: \begin{cases} num1 = 10 \\ num2 = 0 \end{cases} \\ \left\{ \begin{array}{l} num1 \geq 0 \\ num2 \geq 0 \\ num1 = 0 \\ num2 = 0 \end{array} \Rightarrow Test\ case: \begin{cases} num1 = 1 \\ num2 = 0 \end{cases} \end{array} \right.$$

- Path 3:

$$\left\{ \begin{array}{l} num1 \geq 0 \\ num2 \geq 0 \\ num1 \neq 0 \\ num2 \neq 0 \\ num1 \% num2 \neq 0 (L1) \\ num1 \% num2 = 0 (L2) \end{array} \right\} \Rightarrow \left\{ \begin{array}{l} num1 > 0 \\ num2 > 0 \\ num1 \% num2 \neq 0 (L1) \\ num1 \% num2 = 0 (L2) \end{array} \right\} \Rightarrow Test\ case: \begin{cases} num1 = 9 \\ num2 = 6 \end{cases}$$

Testing PrimeCheck algorithm based on “All DU path”

1. Control flow graph



2. Identify definition

Variable	n	i	limit
def	1	6, 9	6
p-use	2, 4, 8	7, 8	7
c-use	6	9	none

3. Generate paths

dc-path

- Variable *n*:

Path 1: $1 \rightarrow 2T \rightarrow 3$

Path 2: $1 \rightarrow 2F \rightarrow 4T \rightarrow 5$

Path 3: $1 \rightarrow 2F \rightarrow 4F \rightarrow 6 \rightarrow 7F \rightarrow 11$

Path 4: $1 \rightarrow 2F \rightarrow 4F \rightarrow 6 \rightarrow 7T \rightarrow 8T \rightarrow 10$

Path 5: $1 \rightarrow 2F \rightarrow 4F \rightarrow 7 \rightarrow 7T \rightarrow 8F \rightarrow 9 \rightarrow 7F \rightarrow 11$

- Variable ***i***:

Path 1: $6 \rightarrow 7T$

Path 2: $6 \rightarrow 7F$

Path 3: $6 \rightarrow 7T \rightarrow 8T$

Path 4: $6 \rightarrow 7T \rightarrow 8F$

Path 5: $6 \rightarrow 7T \rightarrow 8F \rightarrow 9$

Path 6: $9 \rightarrow 7T$

Path 7: $9 \rightarrow 7F$

Path 10: $9 \rightarrow 7T \rightarrow 8T$

Path 11: $9 \rightarrow 7T \rightarrow 8F$

Path 12: $9 \rightarrow 7T \rightarrow 8F \rightarrow 9$

- Variable ***limit***:

Path 1: $6 \rightarrow 7$

Complete paths

- Variable ***n***:

Path 1: $1 \rightarrow 2T \rightarrow 3$

Path 2: $1 \rightarrow 2F \rightarrow 4T \rightarrow 5$

Path 3: $1 \rightarrow 2F \rightarrow 4F \rightarrow 6 \rightarrow 7F \rightarrow 11$

Path 4: $1 \rightarrow 2F \rightarrow 4F \rightarrow 6 \rightarrow 7T \rightarrow 8T \rightarrow 10$

Path 5: $1 \rightarrow 2F \rightarrow 4F \rightarrow 6 \rightarrow 7T \rightarrow 8F \rightarrow 9 \rightarrow 7F \rightarrow 11$

- Variable ***i***:

Path 1: $1 \rightarrow 2F \rightarrow 4F \rightarrow 6 \rightarrow 7F \rightarrow 11$

Path 2: $1 \rightarrow 2F \rightarrow 4F \rightarrow 6 \rightarrow 7T \rightarrow 8T \rightarrow 10$

Path 3: $1 \rightarrow 2F \rightarrow 4F \rightarrow 6 \rightarrow 7T \rightarrow 8F \rightarrow 9 \rightarrow 7F \rightarrow 11$

Path 4: $1 \rightarrow 2F \rightarrow 4F \rightarrow 6 \rightarrow 7T \rightarrow 8F \rightarrow 9 \rightarrow 7T \rightarrow 8F \rightarrow 9 \rightarrow 7T \rightarrow 8T \rightarrow 10$

- Variable ***limit***:

Path 1: $1 \rightarrow 2F \rightarrow 4F \rightarrow 6 \rightarrow 7F \rightarrow 11$

Path 2: $1 \rightarrow 2F \rightarrow 4F \rightarrow 6 \rightarrow 7T \rightarrow 8T \rightarrow 10$

⇒ *To sum up, we have the following paths:*

Path 1: $1 \rightarrow 2T \rightarrow 3$

Path 2: $1 \rightarrow 2F \rightarrow 4T \rightarrow 5$

Path 3: $1 \rightarrow 2F \rightarrow 4F \rightarrow 6 \rightarrow 7F \rightarrow 11$

Path 4: $1 \rightarrow 2F \rightarrow 4F \rightarrow 6 \rightarrow 7T \rightarrow 8T \rightarrow 10$

Path 5: $1 \rightarrow 2F \rightarrow 4F \rightarrow 6 \rightarrow 7T \rightarrow 8F \rightarrow 9 \rightarrow 7F \rightarrow 11$

Path 6: $1 \rightarrow 2F \rightarrow 4F \rightarrow 6 \rightarrow 7T \rightarrow 8F \rightarrow 9 \rightarrow 7T \rightarrow 8F \rightarrow 9 \rightarrow 7T \rightarrow 8T \rightarrow 10$

4. Generate test suite

- Path 1:

Test case: $n = 2$

- Path 2:

$$\left\{ \begin{array}{l} n \neq 2 \\ n < 2 \\ n \% 2 = 0 \end{array} \right\} \Leftrightarrow \left\{ \begin{array}{l} \left\{ \begin{array}{l} n \neq 2 \\ n < 2 \end{array} \right\} \Rightarrow \text{Test case: } n = -1 \\ \left\{ \begin{array}{l} n \neq 2 \\ n \% 2 = 0 \end{array} \right\} \Rightarrow \text{Test case: } n = 4 \end{array} \right.$$

- Path 3:

$$\left\{ \begin{array}{l} n \neq 2 \\ n \geq 2 \\ n \% 2 \neq 0 \\ i > \text{limit} \end{array} \right\} \Rightarrow \text{Test case: } n = 5$$

- Path 4:

$$\left\{ \begin{array}{l} n \neq 2 \\ n \geq 2 \\ n \% 2 \neq 0 \\ i \leq \text{limit} \\ n \% i = 0 \end{array} \right\} \Rightarrow \text{Test case: } n = 15$$

- Path 5:

$$\left\{ \begin{array}{l} n \neq 2 \\ n \geq 2 \\ n \% 2 \neq 0 \\ i \leq \text{limit} \\ n \% i \neq 0 \\ i + 2 > \text{limit} \end{array} \right\} \Rightarrow \text{Test case: } n = 11$$

- Path 6:

$$\left\{ \begin{array}{l} n \neq 2 \\ n \geq 2 \\ n \% 2 \neq 0 \\ i \leq limit \\ n \% i \neq 0 \\ i + 2 \leq limit \\ n \% (i + 2) \neq 0 \\ i + 4 \leq limit \\ n \% (i + 4) = 0 \end{array} \right. \Rightarrow \text{Test case: } n = 49$$