4-6   Scope

Scope determines the region of the program in which a defined object is visible. Scope pertains to any object that can be declared, such as a variable or a function declaration.
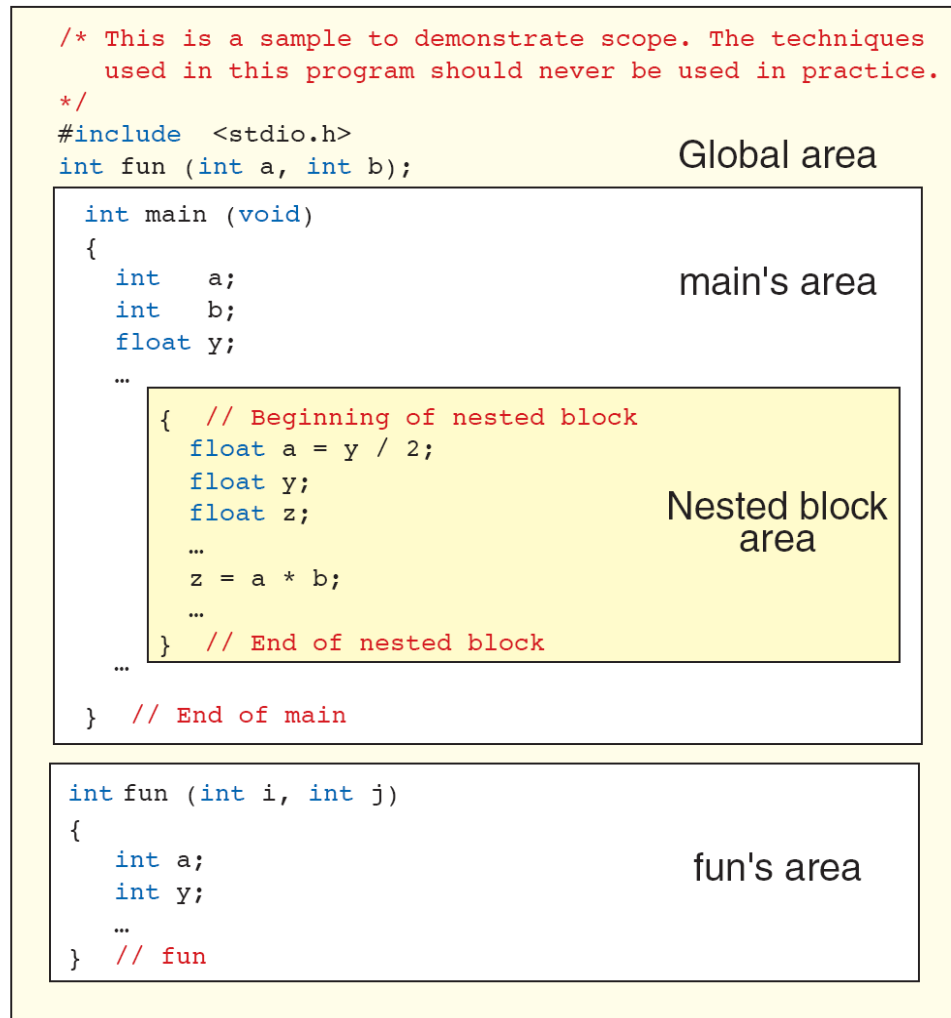
Topics discussed in this section:

Global Scope
Local Scope

```
/* This is a sample to demonstrate scope. The techniques
   used in this program should never be used in practice.
*/
#include  <stdio.h>                        Global area
int fun (int a, int b);

int main (void)
{
    int   a;                                main's area
    int   b;
    float y;

    …
        {  // Beginning of nested block
           float a = y / 2;
           float y;
           float z;                         Nested block
                                                area
           …
           z = a * b;

           …
        }  // End of nested block
    …

}  // End of main


int fun (int i, int j)
{
    int a;                                  fun's area
    int y;

    …
}  // fun
```

FIGURE 4-32 Scope for Global and Block Areas

Note

Variables are in scope from declaration until the end of their block.

4-7 Programming Example— Incremental Development

Top–down development, a concept inherent to modular programming, allows us to develop programs incrementally. By writing and debugging each function separately, we are able to solve the program in smaller steps, making the whole process easier.

Topics discussed in this section:

First Increment: *main* and getData
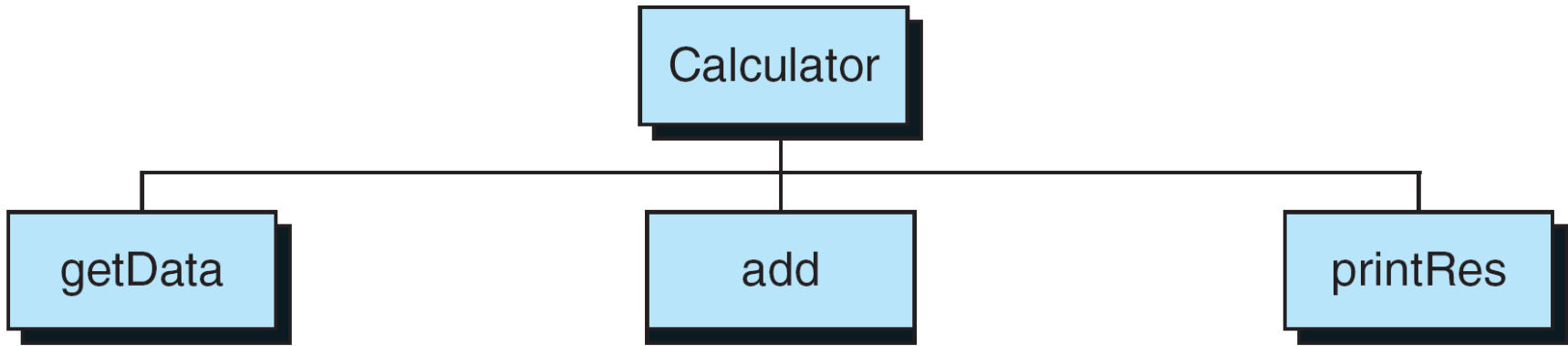Second Increment: add
Final Increment: Print ResultsThe

FIGURE 4-33 Calculator Program Design

PROGRAM 4-13   Calculator Program—First Increment

```c
1   /* This program adds two integers read from the
2      keyboard and prints the results.
3         Written by:
4         Date:
5   */
6   #include <stdio.h>
7
8   //   Function Declarations
9   void getData  (int* a, int* b);
10
11  int main (void)
12  {
13  // Local Declarations
14     int  a;
15     int  b;
16
17  // Statements
18     getData (&a, &b);
19
```

```
20        printf("**main:      a = %d; b = %d\n", a, b);
21
22        return 0;
23  }   // main
24
25  /* ===================== getData =====================
26      This function reads two integers from the keyboard.
27          Pre    Parameters a and b are addresses
28          Post   Data read into parameter addresses
29  */
30  void getData (int* a, int* b)
31  {
32      printf("Please enter two integer numbers: ");
33      scanf("%d %d", a, b);
34
35      printf("**getData: a = %d; b = %d\n", *a, *b);
36      return;
37  }   // getData
```

PROGRAM 4-13   Calculator Program—First Increment

```
Results:
Please enter two integer numbers: 8 13
**getData: a = 8; b = 13
**main:    a = 8; b = 13
```

PROGRAM 4-14   Calculator Program—Second Increment

```c
 1  /* This program adds two integers read
 2     from the keyboard and prints the results.
 3        Written by:
 4        Date:
 5  */
 6  #include <stdio.h>
 7
 8  //   Function Declarations
 9  void getData   (int* a, int* b);
10  int   add         (int  a, int  b);
11
12  int main (void)
13  {
14  // Local Declarations
15      int   a;
16      int   b;
17      int   sum;
18
```

PROGRAM 4-14   Calculator Program—Second Increment

```c
19  // Statements
20     getData (&a, &b);
21
22     sum   = add   (a, b);
23     printf("**main: %d + %d = %d\n", a, b, sum);
24     return 0;
25  }   // main
26
27  /* ===================== getData =====================
28     This function reads two integers from the keyboard.
29        Pre    Parameters a and b are addresses
30        Post   Data read into parameter addresses
31  */
32  void getData (int* a, int* b)
33  {
34     printf("Please enter two integer numbers: ");
35     scanf("%d %d", a, b);
36     return;
37  }   // getData
```

PROGRAM 4-14   Calculator Program—Second Increment

```
38
39   /* ====================== add ======================
40      This function adds two numbers and returns the sum.
41         Pre    a and b contain values to be added
42         Post   Returns a + b
43   */
44   int add (int a, int b)
45   {
46   // Local Definitions
47      int sum;
48
49   // Statements
50      sum = a + b;
51      printf("**add:   %d + %d = %d\n", a, b, sum);
52
53      return sum;
54   }  // add
```

PROGRAM 4-14   Calculator Program—Second Increment

```
Results:
Please enter two integer numbers: 8 13
**add:   8 + 13 = 21
**main: 8 + 13 = 21
```

PROGRAM 4-15   Calculator Program—Final Increment

```c
 1  /* This program adds two integers read
 2     from the keyboard and prints the results.
 3        Written by:
 4        Date:
 5  */
 6  #include <stdio.h>
 7
 8  //   Function Declarations
 9  void getData  (int* a, int* b);
10  int  add        (int  a, int  b);
11  void printRes (int  a, int  b, int sum);
12
13  int main (void)
14  {
15  // Local Declarations
16     int  a;
17     int  b;
```

PROGRAM 4-15   Calculator Program—Final Increment

```
18        int  sum  = 0;
19
20   // Statements
21        getData (&a, &b);
22
23        sum  = add  (a, b);
24
25        printRes (a, b, sum);
26        return 0;
27   }  // main
28
29   /* ===================== getData =====================
30      This function reads two integers from the keyboard.
31          Pre    Parameters a and b
32          Post   Returns a + b
33   */
34   void getData (int* a, int* b)
35   {
```

```
36      printf("Please enter two integer numbers: ");
37      scanf("%d %d", a, b);
38      return;
39   }  // getData
40
41   /* ===================== add =======================
42      This function adds two integers and returns the sum.
43         Pre    Parameters a and b
44         Post   Returns a + b
45   */
46   int add (int a, int b)
47   {
48   // Local Definitions
49      int sum;
50
51   // Statements
52      sum = a + b;
53      return sum;
54   }  // add
```

PROGRAM 4-15   Calculator Program—Final Increment

```
55
56   /* ===================== printRes =====================
57      Prints the calculated results.
58          Pre    a and b contain input; sum the results
59          Post   Data printed
60   */
61   void printRes (int a, int b, int sum)
62   {
63      printf("%4d + %4d = %4d\n", a, b, sum);
64      return;
65   } // printRes
```

```
Results:
Please enter two integer numbers: 8 13
    8 +    13 =    21
```