

C PROGRAMMING

A Modern Approach SECOND EDITION

Answers to Selected Exercises and Programming Projects

The following links lead to answers to selected exercises and programming projects from the [second edition of *C Programming: A Modern Approach*](#). Exercises and projects for which answers are provided are marked with a  icon in the book.

Note: These exercises and projects were originally the even-numbered exercises in the [first edition](#). (The first edition did not distinguish between exercises and programming projects.) For the benefit of readers who have the first edition, the original exercise number is given in square brackets. For example, the notation [was #4] indicates that the number of the exercise (or programming project) was 4 in the first edition. If an answer is different because of second-edition changes, the word "modified" will appear inside the brackets: [was #4; modified].

Please [email](#) me with comments and error reports.

Chapter 2

Answers to Selected Exercises

2. [was #2] (a) The program contains one directive (`#include`) and four statements (three calls of `printf` and one `return`).

(b)

Parkinson's Law:

Work expands so as to fill the time available for its completion.

3. [was #4]

```
#include <stdio.h>
```

```
int main(void)
```

```

{
    int height = 8, length = 12, width = 10, volume;

    volume = height * length * width;

    printf("Dimensions: %dx%dx%d\n", length, width, height);
    printf("Volume (cubic inches): %d\n", volume);
    printf("Dimensional weight (pounds): %d\n", (volume + 165) / 166);

    return 0;
}

```

4. [was #6] Here's one possible program:

```
#include <stdio.h>
```

```

int main(void)
{
    int i, j, k;
    float x, y, z;

    printf("Value of i: %d\n", i);
    printf("Value of j: %d\n", j);
    printf("Value of k: %d\n", k);

    printf("Value of x: %g\n", x);
    printf("Value of y: %g\n", y);
    printf("Value of z: %g\n", z);

    return 0;
}

```

When compiled using GCC and then executed, this program produced the following output:

```

Value of i: 5618848
Value of j: 0
Value of k: 6844404
Value of x: 3.98979e-34
Value of y: 9.59105e-39
Value of z: 9.59105e-39

```

The values printed depend on many factors, so the chance that you'll get exactly these numbers is small.

5. [was #10] (a) is not legal because 100_bottles begins with a digit.

8. [was #12] There are 14 tokens: a, =, (, 3, *, q, -, p, *, p,), /, 3, and ;.

Answers to Selected Programming Projects

4. [was #8; modified]

```
#include <stdio.h>

int main(void)
{
    float original_amount, amount_with_tax;

    printf("Enter an amount: ");
    scanf("%f", &original_amount);
    amount_with_tax = original_amount * 1.05f;
    printf("With tax added: $%.2f\n", amount_with_tax);

    return 0;
}
```

The `amount_with_tax` variable is unnecessary. If we remove it, the program is slightly shorter:

```
#include <stdio.h>

int main(void)
{
    float original_amount;

    printf("Enter an amount: ");
    scanf("%f", &original_amount);
    printf("With tax added: $%.2f\n", original_amount * 1.05f);

    return 0;
}
```

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Chapter 3

Answers to Selected Exercises

2. [was #2]

- (a) `printf("%-8.1e", x);`
- (b) `printf("%10.6e", x);`
- (c) `printf("%-8.3f", x);`

```
(d) printf("%6.0f", x);
```

5. [was #8] The values of x, i, and y will be 12.3, 45, and .6, respectively.

Answers to Selected Programming Projects

1. [was #4; modified]

```
#include <stdio.h>

int main(void)
{
    int month, day, year;

    printf("Enter a date (mm/dd/yyyy): ");
    scanf("%d/%d/%d", &month, &day, &year);
    printf("You entered the date %d%.2d%.2d\n", year, month, day);

    return 0;
}
```

3. [was #6; modified]

```
#include <stdio.h>

int main(void)
{
    int prefix, group, publisher, item, check_digit;

    printf("Enter ISBN: ");
    scanf("%d-%d-%d-%d-%d", &prefix, &group, &publisher, &item, &check_digit);

    printf("GS1 prefix: %d\n", prefix);
    printf("Group identifier: %d\n", group);
    printf("Publisher code: %d\n", publisher);
    printf("Item number: %d\n", item);
    printf("Check digit: %d\n", check_digit);

    /* The five printf calls can be combined as follows:

        printf("GS1 prefix: %d\nGroup identifier: %d\nPublisher code: %d\nItem number:
%d\nCheck digit: %d\n",
            prefix, group, publisher, item, check_digit);
    */

    return 0;
}
```

Chapter 4

Answers to Selected Exercises

2. [was #2] Not in C89. Suppose that i is 9 and j is 7. The value of $(-i)/j$ could be either -1 or -2 , depending on the implementation. On the other hand, the value of $-(i/j)$ is always -1 , regardless of the implementation. In C99, on the other hand, the value of $(-i)/j$ must be equal to the value of $-(i/j)$.

9. [was #6]

- (a) 63 8
- (b) 3 2 1
- (c) 2 -1 3
- (d) 0 0 0

13. [was #8] The expression $++i$ is equivalent to $(i += 1)$. The value of both expressions is i *after* the increment has been performed.

Answers to Selected Programming Projects

2. [was #4]

```
#include <stdio.h>

int main(void)
{
    int n;

    printf("Enter a three-digit number: ");
    scanf("%d", &n);
    printf("The reversal is: %d%d%d\n", n % 10, (n / 10) % 10, n / 100);

    return 0;
}
```

Chapter 5

Answers to Selected Exercises

2. [was #2]

- (a) 1
- (b) 1
- (c) 1
- (d) 1

4. [was #4] $(i > j) - (i < j)$

6. [was #12] Yes, the statement is legal. When n is equal to 5, it does nothing, since 5 is not equal to -9 .

10. [was #16] The output is

onetwo

since there are no break statements after the cases.

Answers to Selected Programming Projects

2. [was #6]

```
#include <stdio.h>
```

```
int main(void)
{
    int hours, minutes;

    printf("Enter a 24-hour time: ");
    scanf("%d:%d", &hours, &minutes);

    printf("Equivalent 12-hour time: ");
    if (hours == 0)
        printf("12:%.2d AM\n", minutes);
    else if (hours < 12)
        printf("%d:%.2d AM\n", hours, minutes);
    else if (hours == 12)
        printf("%d:%.2d PM\n", hours, minutes);
    else
        printf("%d:%.2d PM\n", hours - 12, minutes);

    return 0;
}
```

4. [was #8; modified]

```
#include <stdio.h>
```

```

int main(void)
{
    int speed;

    printf("Enter a wind speed in knots: ");
    scanf("%d", &speed);

    if (speed < 1)
        printf("Calm\n");
    else if (speed <= 3)
        printf("Light air\n");
    else if (speed <= 27)
        printf("Breeze\n");
    else if (speed <= 47)
        printf("Gale\n");
    else if (speed <= 63)
        printf("Storm\n");
    else
        printf("Hurricane\n");

    return 0;
}

```

6. [was #10]

```
#include <stdio.h>
```

```

int main(void)
{
    int check_digit, d, i1, i2, i3, i4, i5, j1, j2, j3, j4, j5,
        first_sum, second_sum, total;

    printf("Enter the first (single) digit: ");
    scanf("%d", &d);
    printf("Enter first group of five digits: ");
    scanf("%d%d%d%d%d", &i1, &i2, &i3, &i4, &i5);
    printf("Enter second group of five digits: ");
    scanf("%d%d%d%d%d", &j1, &j2, &j3, &j4, &j5);
    printf("Enter the last (single) digit: ");
    scanf("%d", &check_digit);

    first_sum = d + i2 + i4 + j1 + j3 + j5;
    second_sum = i1 + i3 + i5 + j2 + j4;
    total = 3 * first_sum + second_sum;

    if (check_digit == 9 - ((total - 1) % 10))
        printf("VALID\n");
    else
        printf("NOT VALID\n");
}

```

```
    return 0;
}
```

10. [was #14]

```
#include <stdio.h>
```

```
int main(void)
{
    int grade;

    printf("Enter numerical grade: ");
    scanf("%d", &grade);

    if (grade < 0 || grade > 100) {
        printf("Illegal grade\n");
        return 0;
    }

    switch (grade / 10) {
        case 10:
        case 9:  printf("Letter grade: A\n");
                 break;
        case 8:  printf("Letter grade: B\n");
                 break;
        case 7:  printf("Letter grade: C\n");
                 break;
        case 6:  printf("Letter grade: D\n");
                 break;
        case 5:
        case 4:
        case 3:
        case 2:
        case 1:
        case 0:  printf("Letter grade: F\n");
                 break;
    }

    return 0;
}
```

Chapter 6

Answers to Selected Exercises

4. [was #10] (c) is not equivalent to (a) and (b), because *i* is incremented *before* the loop body is executed.

10. [was #12] Consider the following while loop:

```
while (...) {  
    ...  
    continue;  
    ...  
}
```

The equivalent code using goto would have the following appearance:

```
while (...) {  
    ...  
    goto loop_end;  
    ...  
loop_end: ; /* null statement */  
}
```

12. [was #14]

```
for (d = 2; d * d <= n; d++)  
    if (n % d == 0)  
        break;
```

The if statement that follows the loop will need to be modified as well:

```
if (d * d <= n)  
    printf("%d is divisible by %d\n", n, d);  
else  
    printf("%d is prime\n", n);
```

14. [was #16] The problem is the semicolon at the end of the first line. If we remove it, the statement is now correct:

```
if (n % 2 == 0)  
    printf("n is even\n");
```

Answers to Selected Programming Projects

2. [was #2]

```
#include <stdio.h>
```

```
int main(void)
```

```

{
    int m, n, remainder;

    printf("Enter two integers: ");
    scanf("%d%d", &m, &n);

    while (n != 0) {
        remainder = m % n;
        m = n;
        n = remainder;
    }

    printf("Greatest common divisor: %d\n", m);

    return 0;
}

```

4. [was #4]

```

#include <stdio.h>

int main(void)
{
    float commission, value;

    printf("Enter value of trade: ");
    scanf("%f", &value);

    while (value != 0.0f) {
        if (value < 2500.00f)
            commission = 30.00f + .017f * value;
        else if (value < 6250.00f)
            commission = 56.00f + .0066f * value;
        else if (value < 20000.00f)
            commission = 76.00f + .0034f * value;
        else if (value < 50000.00f)
            commission = 100.00f + .0022f * value;
        else if (value < 500000.00f)
            commission = 155.00f + .0011f * value;
        else
            commission = 255.00f + .0009f * value;

        if (commission < 39.00f)
            commission = 39.00f;

        printf("Commission: $%.2f\n\n", commission);

        printf("Enter value of trade: ");
        scanf("%f", &value);
    }
}

```