C Primer Plus Sixth Edition Programming Exercise Answers

Chapter 2 Programming Exercises

PE 2-1

```
/* Programming Exercise 2-1  */
#include <stdio.h>
int main(void)
{
    printf("Gustav Mahler\n");
    printf("Gustav\nMahler\n");
    printf("Gustav ");
    printf("Mahler\n");
    return 0;
}
```

PE 2-2

```
/* Programming Exercise 2-2  */
#include <stdio.h>
int main(void)
{
    printf("Adam West\n");
    printf("2011 C Primer Plus Street\n");
    printf("West San Francisco, CA 94188\n");
    return 0;
}
```

PE 2-3

```
/* Programming Exercise 2-3  */
#include <stdio.h>
int main(void)
{
    int ageyears;    /* age in years */
    int agedays;    /* age in days  */
                    /* large ages may require the long type */
    ageyears = 101;
    agedays = 365 * ageyears;
    printf("An age of %d years is %d days.\n", ageyears, agedays);
    return 0;
}
```

PE 2-4

```
/* Programming Exercise 2-4  */
#include <stdio.h>
void jolly(void);
void deny(void);
int main(void)
{
    jolly();
    jolly();
    jolly();
    deny();
    return 0;
}
void jolly(void)
{
    printf("For he's a jolly good fellow!\n");
}
void deny(void)
{
    printf("Which nobody can deny!\n");
}
```

PE 2-5

```
/* Programming Exercise 2-5  */
#include <stdio.h>
void br(void);
void ic(void);
int main(void)
{
    br();
    printf(", ");
    ic();
    printf("\n");
    ic();
    printf(",\n");
    br();
    printf("\n");
    return 0;
}
void br(void)
{
    printf("Brazil, Russia");
}
void ic(void)
{
    printf("India, China");
}
```

PE 2-6

```
/* Programming Exercise 2-6  */
#include <stdio.h>
int main(void)
{
    int toes;

    toes = 10;

    printf("toes = %d\n", toes);
    printf("Twice toes = %d\n", 2 * toes);
    printf("toes squared = %d\n", toes * toes);
    return 0;
}
/* or create two more variables, set them to 2 * toes and toes * toes */
```

PE 2-7

```
/* Programming Exercise 2-7  */
#include <stdio.h>
void smile(void);
int main(void)
{
    smile();
    smile();
    smile();
    printf("\n");
    smile();
    smile();
    printf("\n");
    smile();
    printf("\n");
    return 0;
}
void smile(void)
```

```
{
    printf("Smile!");
}
/* cutting and pasting text is handy here */
```

PE 2-8

```
/* Programming Exercise 2-8  */
#include <stdio.h>
void one_three(void);
void two(void);
int main(void)
{
    printf("starting now:\n");
    one_three();
    printf("done!\n");
    return 0;
}
void one_three(void)
{
    printf("one\n");
    two();
    printf("three\n");
}
void two(void)
{
    printf("two\n");
}
```

Chapter 3 Programming Exercises

PE 3-1

```
/* Programming Exercise 3-1  */
/* This program requires some knowledge of what the largest and smallest
   values might be. The limits.h and float.h header files, discussed in
   Chapter 4, can provide better values */
#include <stdio.h>
int main(void)
{
    int ibig = 2147483647;
    float big = 1.0e37;
    float small = 1.0e-37;


    printf("ibig: %d, big + 1: %d\n", ibig, ibig + 1);
    printf("big: %e, too big: %e\n", big, big * big);
    printf("small: %e, too small: %e\n", small, small / big);

    return 0;
}
```

PE 3-2

```
/* Programming Exercise 3-2  */
#include <stdio.h>
int main(void)
{
    int ascii;

    printf("Enter an ASCII code: ");
    scanf("%d", &ascii);
    printf("%d is the ASCII code for %c.\n", ascii, ascii);
```

```
    return 0;
}
```

PE 3-3

```
/* Programming Exercise 3-3  */
#include <stdio.h>
int main(void)
{
    printf("\aStartled by the sudden sound, Sally shouted,\n");
    printf("\"By the Great Pumpkin, what was that!\"\n");
    return 0;
}
```

PE 3-4

```
/* Programming Exercise 3-4  */
#include <stdio.h>
int main(void)
{
    float num;
    printf("Enter a floating-point value: ");
    scanf("%f", &num);
    printf("fixed-point notation: %f\n", num);
    printf("exponential notation: %e\n", num);
    printf("p notation: %a\n", num);
    return 0;
}
```

PE 3-5

```
/* Programming Exercise 3-5  */
#include <stdio.h>
int main(void)
{
    float sec_per_year = 3.156e7;    /* seconds in a year */
    float age;
    float age_in_sec;

    printf("Enter your age in years: ");
    scanf("%f", &age);
    age_in_sec = age * sec_per_year;
    printf("Your age is %e seconds.\n", age_in_sec);
    return 0;
}
```

PE 3-6

```
/* Programming Exercise 3-6  */
#include <stdio.h>
int main(void)
{
    float mass_mol = 3.0e-23;    /* mass of water molecule in grams */
    float mass_qt = 950;        /* mass of quart of water in grams */
    float quarts;
    float molecules;

    printf("Enter the number of quarts of water: ");
    scanf("%f", &quarts);
    molecules = quarts * mass_qt / mass_mol;
    printf("%f quarts of water contain %e molecules.\n", quarts, molecules);
    return 0;
}
```

PE 3-7

```
/* Programming Exercise 3-7  */
#include <stdio.h>
int main(void)
{
    float inches;
    float centimeters;

    printf("Enter your height in inches: ");
    scanf("%f", &inches);
    centimeters = 2.54 * inches;
    printf("%f inches are %f centimeters\n", inches, centimeters);
    return 0;
}
```

PE 3-8

```
//  pe3-8.c
#include <stdio.h>
int main(void)
{
    // use float to allow for fractional parts, as in
    // 3 cups being 1.5 pints
    float pints, cups, ounces, tablespoons, teaspoons;

    printf("PLease enter the volume in cups: ");
    scanf("%f", &cups);
    pints = cups/2.0;
    ounces = 8.0 * cups;
    tablespoons = 2.0 * ounces;
    teaspoons= 3.0 * tablespoons;
    printf("%f cups are equivalent to each of the following:\n", cups);
    printf("%f pints\n", pints);
    printf("%f tablespoons\n", tablespoons);
    printf("%f teaspoons\n", teaspoons);

    return 0;
}
```

Chapter 4 Programming Exercises

PE 4-1

```
/* Programming Exercise 4-1  */
#include <stdio.h>
int main(void)
{
    char fname[40];
    char lname[40];

    printf("Enter your first name: ");
    scanf("%s", fname);
    printf("Enter your last name: ");
    scanf("%s", lname);
    printf("%s, %s\n", lname, fname);
    return 0;
}
```

PE 4-2

```
/* Programming Exercise 4-2 */
#include <stdio.h>
```

```
#include <string.h>
int main(void)
{
    char fname[40];
    int fieldwidth;

    printf("Enter your first name: ");
    scanf("%s", fname);
    fieldwidth = strlen(fname) + 3;
    printf("\"%s\"\n", fname);
    printf("\"%20s\"\n", fname);
    printf("\"%-20s\"\n", fname);
    printf("%*s\n", fieldwidth, fname);
    return 0;
}
```

PE 4-3

```
/* Programming Exercise 4-3 */
#include <stdio.h>
int main(void)
{
    double value;

    printf("Enter a floating-point number: ");
    scanf("%lf", &value);
    printf("The input is %.1f or %.1e.\n", value, value);
    printf("The input is %+.3f or %.3e.\n", value, value);

    return 0;
}
```

PE 4-4

```
/* Programming Exercise 4-4 */
#include <stdio.h>
int main(void)
{
    float height;
    char name[40];

    printf("Enter your height in inches: ");
    scanf("%f", &height);
    printf("Enter your name: ");
    scanf("%s", name);
    printf("%s, you are %.3f feet tall\n", name, height / 12.0);

    return 0;
}
```

PE 4-5

```
//  pe4-5.c
#define bitsperbyte 8
#include <stdio.h>
int main(void)
{
    float mbs;        // megabits per second
    float file_size;  // size of file in megabytes
    float download_time;

    printf("Enter the download speed in megabits per second: ");
    scanf("%f", &mbs);
    printf("Enter the file size in megabytes: ");
```

```
    scanf("%f", &file_size);
    download_time = bitsperbyte * file_size/ mbs;
    printf("At %.2f megabits per second, a file of %.2f megabytes\n",
           mbs, file_size);
    printf("downloads in %.2f seconds.\n", download_time);

    return 0;
}
```

PE 4-6

```
/* Programming Exercise 4-6 */
#include <stdio.h>
#include <string.h>
int main(void)
{
    char fname[40];
    char lname[40];
    int flen;        /* length of first name */
    int llen;        /* length of last name  */

    printf("Enter your first name: ");
    scanf("%s", fname);
    printf("Enter your last name: ");
    scanf("%s", lname);
    flen = strlen(fname);
    llen = strlen(lname);
    printf("%s %s\n", fname, lname);
    printf("%*d %*d\n", flen, flen, llen, llen);
    printf("%s %s\n", fname, lname);
    printf("%-*d %-*d\n", flen, flen, llen, llen);

    return 0;
}
```

PE 4-7

```
/* Programming Exercise 4-7 */
#include <stdio.h>
#include <float.h>
int main(void)
{
    float ot_f = 1.0 / 3.0;
    double ot_d = 1.0 / 3.0;

    printf(" float values: ");
    printf("%.4f %.12f %.16f\n", ot_f, ot_f, ot_f);
    printf("double values: ");
    printf("%.4f %.12f %.16f\n", ot_d, ot_d, ot_d);
    printf("FLT_DIG: %d\n", FLT_DIG);
    printf("DBL_DIG: %d\n", DBL_DIG);
    return 0;
}
```

PE 4-8

```
/* Programming Exercise 4-8 */
#include <stdio.h>
int main(void)
{
    const double LIT_PER_GAL = 3.785;
    const double KM_PER_MI = 1.609;
    double miles;
    double gallons;
```

```
    double mpg;
    double lit_per_100km;
    printf("Enter the number of miles traveled: ");
    scanf("%lf", &miles);
    printf("Enter the number of gallons consumed: ");
    scanf("%lf", &gallons);
    mpg = miles / gallons;
    lit_per_100km = (gallons * LIT_PER_GAL)/ (miles * KM_PER_MI / 100.0);
    printf("Fuel consumption is %.1f mpg or %.1f liters / 100 km\n",
            mpg, lit_per_100km);

    return 0;
}
```

Chapter 5 Programming Exercises

PE 5-1

```
/* Programming Exercise 5-1 */
#include <stdio.h>
int main(void)
{
    const int minperhour = 60;
    int minutes, hours, mins;

    printf("Enter the number of minutes to convert: ");
    scanf("%d", &minutes);
    while (minutes > 0 )
    {
        hours = minutes / minperhour;
        mins = minutes % minperhour;
        printf("%d minutes = %d hours, %d minutes\n", minutes, hours, mins);
        printf("Enter next minutes value (0 to quit): ");
        scanf("%d", &minutes);
    }
    printf("Bye\n");

    return 0;
}
```

PE 5-2

```
/* Programming Exercise 5-2 */
#include <stdio.h>
int main(void)
{
    int start, finish;

    printf("Enter a beginning integer: ");
    scanf("%d", &start);
    finish = start + 10;
    while (start <= finish)  // or start < finish + 1
        printf("%d ", start++);

    printf("\nBye\n");

    return 0;
}
```

PE 5-3

```
/* Programming Exercise 5-3 */
#include <stdio.h>
```

```
int main(void)
{
    const int daysperweek = 7;
    int days, weeks, day_rem;

    printf("Enter the number of days: ");
    scanf("%d", &days);
    while (days > 0)
    {
        weeks = days / daysperweek;
        day_rem = days % daysperweek;
        printf("%d days are %d weeks and %d days.\n",
               days, weeks, day_rem);

        printf("Enter the number of days (0 or less to end): ");
        scanf("%d", &days);
    }
    printf("Done!\n");
    return 0;
}
```

PE 5-4

```
/* Programming Exercise 5-4 */
/* pe5-4.c                  */
#include <stdio.h>
const double CM_PER_INCH = 2.54;
const int INCH_PER_FOOT = 12;
int main()
{
    double cm;
    double inches;
    int feet;

    printf("Enter a height in centimeters: ");
    scanf("%lf", &cm);
    while (cm > 0)
    {
        inches = cm / CM_PER_INCH;
        feet = (int) inches / INCH_PER_FOOT;
        inches = inches - feet * INCH_PER_FOOT;
        printf("%.1f cm = %d feet, %.1f inches\n",
               cm, feet, inches);
        printf("Enter a height in centimeters (<=0 to quit): ");
           scanf("%lf", &cm);
    }
    printf("bye\n");
    return 0;
}
```

PE 5-5

```
/* Programming Exercise 5-5 */
#include <stdio.h>
int main(void)    /* finds sum of first n integers */
{
  int count, sum;
  int n;

  printf("Enter the upper limit: ");
  scanf("%d", &n);
  count = 0;
  sum = 0;
  while (count++ < n)
```

```
     sum = sum + count;
  printf("sum = %d\n", sum);
  return 0;
}
```

PE 5-6

```
/* Programming Exercise 5-6 */
#include <stdio.h>
int main(void)    /* finds sum of squares of first n integers */
{
  int count, sum;
  int n;

  printf("Enter the upper limit: ");
  scanf("%d", &n);
  count = 0;
  sum = 0;
  while (count++ < n)
     sum = sum + count * count;
  printf("sum of squares of first %d integers = %d\n", n ,sum);
  return 0;
}
```

PE 5-7

```
/* Programming Exercise 5-7 */
#include <stdio.h>
void showCube(double x);
int main(void)    /* finds cube of entered number */
{
     double val;

     printf("Enter a floating-point value: ");
     scanf("%lf", &val);
     showCube(val);

    return 0;
}
void showCube(double x)
{
    printf("The cube of %e is %e.\n", x, x*x*x );
}
```

PE 5-8

```
// Programming exercise 5-8
#include <stdio.h>
int main(void)
{
    int number;
    int result;
    int n_mod;

    printf("This program computes moduli.\n");
    printf("Enter an integer to serve as the second operand: ");
    scanf("%d", &n_mod);
    printf("Now enter the first operand: ");
    scanf("%d", &number);
    while (number > 0)
    {
        result = number % n_mod;
        printf("%d %% %d is %d\n", number, n_mod, result);
        printf("Enter next number for first operand (<= 0 to quit): ");
```

```
        scanf("%d", &number);
    }
    printf("Done\n");

    return 0;
}
```

PE 5-9

```
/* Programming Exercise 5-9 */
#include <stdio.h>
void Temperature(double n);
int main(void)
{
    double temp_F;
    int items_read;;

    printf("Enter a Fahrenheit temperature: ");
    items_read = scanf("%lf", &temp_F);
    while (items_read  == 1)  // or items_red > 0
    {
        Temperature(temp_F);
        printf("Enter a Fahrenheit temperature (q to quit): ");
        items_read = scanf("%lf", &temp_F);
    }
    printf("Done.\n");

    return 0;
}
void Temperature(double t_f)
{
    const double SCALE = 1.8;
    const double F2C_ZERO = 32.0;
    const double C2K_ZERO = 273.16;

    double t_c;    /* celsius value */
    double t_k;    /* kelvin value  */

    t_c = (t_f - F2C_ZERO) / SCALE;
    t_k = t_c + C2K_ZERO;

    printf("%-16s: %.2f\n", "Fahrenheit", t_f);
    printf("%-16s: %.2f\n", "Celsius", t_c);
    printf("%-16s: %.2f\n", "Kelvin", t_k);

    return;
}
```

Chapter 6 Programming Exercises

PE 6-1

```
/* pe6-1.c */
/* this implementation assumes the character codes */
/* are sequential, as they are in ASCII.           */
#include <stdio.h>
#define SIZE 26
int main( void )
{
    char lcase[SIZE];
    int i;
```

```
    for (i = 0; i < SIZE; i++)
        lcase[i] = 'a' + i;
    for (i = 0; i < SIZE; i++)
        printf("%c", lcase[i]);
    printf("\n");
    return 0;
}
```

PE 6-2

```
/* pe6-2.c */
#include <stdio.h>
#define LIMIT 5
int main( void )
{
    int i, j;

    for (i = 0; i < LIMIT; i++)
    {
        for (j = 0; j <= i; j++)
            printf("$");
        printf("\n");
    }

    return 0;
}
```

PE 6-3

```
/* pe6-3.c */
/* this implementation assumes the character codes */
/* are sequential, as they are in ASCII.           */
#include <stdio.h>
int main( void )
{
    char let = 'F';
    char start;
    char end;

    for (end = let; end >= 'A'; end--)
    {
        for (start = let; start >= end; start--)
            printf("%c", start);
        printf("\n");
    }

    return 0;
}
```

PE 6-4

```
// pe6-4.c -- using dependent nested loops
#include <stdio.h>
int main(void)
{
    const int ROWS = 7;
    int row, col;
    char ch = 'A';

    for (row = 1; row <+ ROWS; row++)
    {
        for (col = 1; col <= row; col++)
            printf("%c", ch++);
```

```
        printf("\n");
    }

    return 0;
}
```

PE 6-5

```
/* pe6-5.c */
/* this implementation assumes the character codes */
/* are sequential, as they are in ASCII.           */
#include <stdio.h>
int main( void )
{
    char let;
    char start;
    char ch;
    int i;
    int spaces;

    printf("Please enter an uppercase letter: ");
    scanf("%c", &let);

    for (start = 'A'; start <= let; start++)
    {
        spaces = let - start;
        for (i = 0; i < spaces; i++)
            printf(" ");

/*    or, using fewer variables, use this:
        for (ch = start; ch < let; ch++)
            printf(" ");
*/
        for (ch = 'A'; ch < start; ch++)
            printf("%c", ch);
        for (ch = start; ch >= 'A'; ch--)
            printf("%c", ch);
        printf("\n");
    }

    return 0;
}
```

PE 6-6

```
/* pe6-6.c */
#include <stdio.h>
int main( void )
{
    int lower, upper, index;
    int square, cube;

    printf("Enter starting integer: ");
    scanf("%d", &lower);
    printf("Enter ending integer: ");
    scanf("%d", &upper);

    printf("%5s %10s %15s\n", "num", "square", "cube");
    for (index = lower; index <= upper; index++)
    {
        square = index * index;
        cube = index * square;
        printf("%5d %10d %15d\n", index, square, cube);
    }
```

```
    return 0;
}
```

PE 6-7

```
/* pe6-7.c */
#include <stdio.h>
#include <string.h>
int main( void )
{
    char input[81];
    int i;
    int length;

    printf("Enter a word: ");
    scanf("%s", input);
    length = strlen(input);
    for (i = length - 1; i >= 0; i--)
        printf("%c", input[i]);
    printf("\n");
    return 0;
}
```

PE 6-8

```
/* pe6-8.c */
#include <stdio.h>
int main( void )
{
    double n, m;
    double res;

    printf("Enter a pair of numbers: ");

    while (scanf("%lf %lf", &n, &m) == 2)
    {
        res = (n - m) / (n * m);
        printf("(%.3g - %.3g)/(%.3g*%.3g) = %.5g\n", n, m, n, m, res);
        printf("Enter next pair (non-numeric to quit): ");
    }

    return 0;
}
```

PE 6-9

```
/* pe6-9.c */
#include <stdio.h>
double diffdiv(double a, double b);
int main( void )
{
    double n, m;
    double res;

    printf("Enter a pair of numbers: ");

    while (scanf("%lf %lf", &n, &m) == 2)
    {
        res = diffdiv(n, m);
        printf("(%.3g - %.3g)/(%.3g*%.3g) = %.5g\n", n, m, n, m, res);
        printf("Enter next pair (non-numeric to quit): ");
    }
```

```
    return 0;
}
double diffdiv(double a, double b)
{
    return (a - b) / (a * b);
}
```

PE 6-10

```
//pe6-10.c
#include <stdio.h>
int main(void)
{
    int lower;
    int upper;
    int i;
    long total;

    printf("Enter lower and upper integer limits: ");
    scanf("%d %d", &lower, &upper);
    while (lower < upper)
    {
           for (i = lower, total = 0; i <= upper; ++i)
               total += i*i;
           printf("The sums of the squares from %d to %d",
                    lower * lower, upper * upper);
           printf(" is %ld\n", total);
           printf("Enter next set of limits: ");
        scanf("%d %d", &lower, &upper);
    }
    printf("Done\n");

    return 0;
}
```

PE 6-11

```
/* pe6-11.c */
#include <stdio.h>
#define SIZE 8
int main( void )
{
    int vals[SIZE];
    int i;

    printf("Please enter %d integers.\n", SIZE);
    for (i = 0; i < SIZE; i++)
        scanf("%d", &vals[i]);
    printf("Here, in reverse order, are the values you entered:\n");
    for (i = SIZE - 1; i >= 0; i--)
        printf("%d ", vals[i]);
    printf("\n");

    return 0;
}
```

PE 6-12

```
/* pe6-12.c */
#include <stdio.h>
int main( void )
{
    double sum1;
    double sum2;
```

```
    int terms;
    int i;
    int sign = 1;

    printf("Please enter the number of terms: ");
    scanf("%d", &terms);
    while (terms > 0)
    {

        for (i = 1, sum1 = 0; i <= terms; i++)
            sum1 += 1.0 / i; /* use 1.0 to force floating-point division */

        for (i = 1, sum2 = 0; i <= terms; i++)
        {
            sum2 += sign * 1.0 / i;
            sign *= -1;      /* change sign for next calculation         */
        }

        printf("sum of series #1 = %f\n", sum1);
        printf("sum of series #2 = %f\n", sum2);
        printf("Enter number of terms (0 to quit): ");
        scanf("%d", &terms);
    }

    return 0;
}

/* sample runs showing #3 converges and #1 does not
Please enter the number of terms: 100
sum of series #1 = 5.187378
sum of series #2 = 0.688172
Enter number of terms (0 to quit): 1000
sum of series #1 = 7.485471
sum of series #2 = 0.692647
Enter number of terms (0 to quit): 10000
sum of series #1 = 9.787606
sum of series #2 = 0.693097
Enter number of terms (0 to quit): 100000
sum of series #1 = 12.090146
sum of series #2 = 0.693142
Enter number of terms (0 to quit): 1000000
sum of series #1 = 14.392727
sum of series #2 = 0.693147
*/
```

PE 6-13

```
/* pe6-13.c */
/* This version starts with the 0 power */
#include <stdio.h>
#define SIZE 8
int main( void )
{
    int twopows[SIZE];
    int i;
    int value = 1;    /* 2 to the 0 */

    for (i = 0; i < SIZE; i++)
    {
        twopows[i] = value;
        value *= 2;
    }

    i = 0;
```