HW2 Solutions

Chapter 3 exercise 15

```c
/**
 * Calculate the volume of a sphere
 * based on user input.
 * Author: Nicolas Ventura
 */

#include <stdio.h>
#include <math.h>

int main(void)
{
    double pi = M_PI,
           r = 5.0,
           volume;
    printf("Input the radius in meter:\n");
    scanf("%lf", &r);
    /* Calculate the volume. */
    volume = (4.0 / 3.0) * pi * r * r * r;
    /* Display the result. */
    printf("volume = %f m^3\n", volume);
    return 0;
}
```

Chapter 4 exercise 12cfi

```c
/**
 * Write the corresponding C mathematical expressions.
 * Author: Nicolas Ventura
 */

int main(void) {
    double c, f, i, r, x, y;
    /* Part (c) */
    c = (4.0 / 3) * 3.14 * r * r * r;
    /* Part (f) */
    f = (x >= y && x >= 0);
    /* Part (i) */
    i = (1 < x && x < 20) || (3 >= y && y >= 1);
    return 0;
}
```

Chapter 4 exercise 17e

```c
/**
 * Find the roots of x^2 - 4x + 4
 * Author: Nicolas Ventura
 */

#include <stdio.h>
#include <math.h>

int main(void) {
```

```
    double a, b, c, x1, x2;
    a = 1;
    b = -4;
    c = 4;
    x1 = (-b + sqrt(b * b - 4 * a * c)) / (2 * a);
    x2 = (-b - sqrt(b * b - 4 * a * c)) / (2 * a);
    printf("x1 = %f\n", x1);
    printf("x2 = %f\n", x2);
    return 0;
}
```

Chapter 4 exercise 19d

```
/**
 * Calculate the value of g4(x) when x=3.5
 * Author: Nicolas Ventura
 */

#include <stdio.h>
#include <math.h>

int main(void) {
    double x = 3.5;
    double result;
    result = (3 * x * x + 4 * x + 3) / (5 * sin(x * x) + 4 * x * x
    + 3);
    printf("g4(%lf) = %lf\n", x, result);
    return 0;
}
```

Chapter 4 exercise 20d

```
/**
 * Calculate the value of g4(x) when x=3.5
 * Author: Nicolas Ventura
 */

#include <stdio.h>
#include <math.h>

int main(void) {
    double x = 3.5;
    double result;
    result = (3 * x * x + 4 * x + 3) / (5 * sin(x * x) + 4 * x * x
    + 3);
    printf("g4(%lf) = %lf\n", x, result);
    return 0;
}
```

Chapter 4 exercise 22f

```
/**
 * Compute the law of cosines.
 * Author: Nicolas Ventura
 */

#include <stdio.h>
```

```c
#include <math.h>

int main(void) {
    double a, b, c, gamma;
    a = 3.83;
    b = 5;
    c = 6;
    gamma = acos((a * a + b * b - c * c) / (2 * a * b));
    printf("gamma in radian = %lf\n", gamma);
    printf("gamma in degree = %lf\n", gamma * 180 / M_PI);
    return 0;
}
```

Chapter 4 exercise 29

```c
printf("40 degrees in Celsius is %f degrees in Fahrenheit\n", 9.0 *
     40 / 5 + 32);
```

Chapter 5 exercise 14d

```c
/* File: ch5ex14d.c */

#include <stdio.h>
#include <math.h>

int main(void)
{
    double x, x0, xf, xstep, result;
    int i, n;
    printf("    x       f4(x)\n");
    printf("  ---------------\n");
    x0 = -1.0;                  /* initial value for x */
    xf = 5.0;                   /* final value for x */
    xstep = 0.25;               /* step size for x */
    n = (xf - x0) / xstep + 1;  /* number of points */
    for (i = 0; i < n; i++)
    {
        x = x0 + i * xstep;     /* calculate value x */
        result = (3 * x * x + 4 * x + 3) / (5 * sin(x * x) + 4 * x
    * x + 3);
        printf("%8.4f %8.4f\n", x, result);
    }
    return 0;
}
```

Chapter 5 exercise 15d

```c
/* File: ch5ex15d.c */

#include <stdio.h>
#include <math.h>

int main(void)
{
    double x, x0, xf, xstep, y, y0, yf, ystep, result;
    int i, j, nx, ny;
    printf("      x          y     f8(x,y)\n");
```

```
    printf("  ----------------------------\n");
    x0 = -1.0;
    xf = 5.0;
    xstep = 1.0;
    nx = (xf - x0) / xstep + 1; /* num of points for x */
    y0 = 2.0;
    yf = 4.0;
    ystep = 0.5;
    ny = (yf - y0) / ystep + 1; /* num of points for y */
    for (i = 0; i < nx; i++)
    {
        x = x0 + i * xstep; /* calculate value for x */
        for (j = 0; j < ny; j++)
        {
            y = y0 + j * ystep; /* calculate value for y */
            result = (3 * x * x + 4 * y + 3) / (5 * sin(y * y) + 4
    * x * x + 6);
            printf("%10.4f %10.4f %8.4f\n", x, y, result);
        }
    }
    return 0;
}
```

Chapter 5 exercise 21

```
/**
 * Calculate the interest over a period of 30 years.
 * Author: Nicolas Ventura
 */

#include <stdio.h>
#include <math.h>

int main(void)
{
    int n;
    double y, p, r;
    printf("Enter the principal ($): ");
    scanf("%lf", &p);
    printf("Enter the interest rate (%%): ");
    scanf("%lf", &r);
    printf("Year  Total\n");
    for (n = 1; n <= 30; n++)
    {
        y = p * pow((1.0 + r / 100), n);
        printf("%3d  $%.2f\n", n, y);
    }
    return 0;
}
```

```
Enter the principal ($): 10000
Enter the interest rate (%): 8
Year  Total
  1  $10800.00
  2  $11664.00
  3  $12597.12
  4  $13604.89
```

```
 5  $14693.28
 6  $15868.74
 7  $17138.24
 8  $18509.30
 9  $19990.05
10  $21589.25
11  $23316.39
12  $25181.70
13  $27196.24
14  $29371.94
15  $31721.69
16  $34259.43
17  $37000.18
18  $39960.19
19  $43157.01
20  $46609.57
21  $50338.34
22  $54365.40
23  $58714.64
24  $63411.81
25  $68484.75
26  $73963.53
27  $79880.61
28  $86271.06
29  $93172.75
30  $100626.57
```

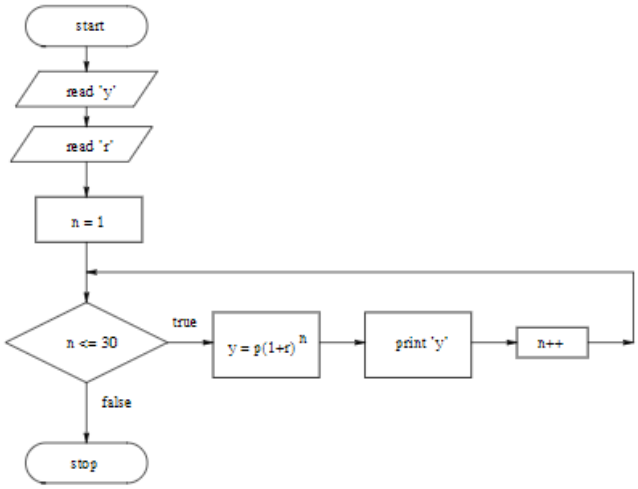

Image 1: Flowchart

Chapter 5 exercise 28

```
/**
 * Render the multiplication table.
 * Author: Nicolas Ventura
 */

```

```c
#include <stdio.h>

int main(void) {
    int i, j;
    printf("        10  9   8   7   6   5   4   3   2   1\n");
    printf("  ----------------------------------------\n");
    for (i = 10; i >= 1; i--)
    {
        /* Outer loop */
        printf("%4d|", i);
        for (j = 10; j >= i; j--)
        {
            /* Inner loop */
            printf("%4d", i * j);
        }
        printf("\n");
    }
    printf("  ----------------------------------------\n");
    return 0;
}
```

Chapter 5 exercise 37

```c
/**
 * Calculate machine epsilon using while loops.
 * Author: Nicolas Ventura
 */

#include <stdio.h>
#include <float.h>

int main(void) {
    float epsilon;
    double depsilon;
    /* Compute float epsilon */
    epsilon = 1.0f;
    while (epsilon + 1.0f > 1.0f) {
        epsilon /= 2.0f;
    }
    epsilon *= 2.0;
    printf("The float machine epsilon is  %e\n", epsilon);
    printf("FLT_EPSILON is                %e\n", FLT_EPSILON);
    /* Compute double epsilon */
    depsilon = 1.0;
    while (depsilon + 1.0 > 1.0) {
        depsilon /= 2.0;
    }
    depsilon *= 2.0;
    printf("The double machine epsilon is %e\n", depsilon);
    printf("DBL_EPSILON is                %e\n", DBL_EPSILON);
    return 0;
}
```