HW4Solutions

Chapter 17 exercise 1

```
> double x = 2.0, y = 3.0;
> 5.0*complex(1.0, 3.0)*complex(x, y)+4.0
complex(-31.0000,45.0000)
```

Chapter 17 exercise 2cd

```
/**
 * Compute the real, imaginary, magnitude, and
 * phase angle of various complex numbers.
 * Author: Nicolas Ventura
 */

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

int main(void) {
    double complex z3, z4;
    z3 = complex(7, 15) / complex(9, 30);
    z4 = polar(3, 2.3 * M_PI) + polar(4, 3.4 * M_PI);
    /* Print results of z3 and z4 */
    printf("z3 = %f\n", z3);
    printf("z4 = %f\n\n", z4);
    /* Part (c) */
    printf("real(z3) = %.3f\n", real(z3));
    printf("imag(z3) = %.3f\n", imag(z3));
    printf("abs(z3) = %.3f\n", abs(z3));
    printf("carg(z3) = %.3f\n\n", carg(z3));
    /* Part (d) */
    printf("real(z4) = %.3f\n", real(z4));
    printf("imag(z4) = %.3f\n", imag(z4));
    printf("abs(z4) = %.3f\n", abs(z4));
    printf("carg(z4) = %.3f\n\n", carg(z4));
    return 0;
}
```

```
z3 = complex(0.522936,-0.076453)
z4 = complex(0.527288,-1.377175)

real(z3) = 0.523
imag(z3) = -0.076
abs(z3) = 0.528
carg(z3) = -0.145

real(z4) = 0.527
imag(z4) = -1.377
abs(z4) = 1.475
carg(z4) = -1.205
```

Chapter 17 exercise 3

```c
/**
 * Compute the value of z6.
 * Author: Nicolas Ventura
 */

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

int main(void) {
    double complex z1 = complex(3, 4),
                   z2 = polar(5, deg2rad(40.0)),
                   z3 = complex(4, 4),
                   z4, z5, z6;

    z4 = z1 * z2 - z2 * z3;
    z5 = z1 / z3 - z1 * z3;
    z6 = z4 - z1 * z5 + z2;

    printf("z4 = %.3f\n", z4);
    printf("z5 = %.3f\n", z5);
    printf("z6 = %.3f\n", z6);

    return 0;
}
```

```
z4 = complex(-3.830,-3.214)
z5 = complex(4.875,-27.875)
z6 = complex(-126.125,64.125)
```

Chapter 17 exercise 5

```c
/**
 * Compute the roots of a quadratic equation.
 * Author: Nicolas Ventura
 */

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

int main(void) {
    /* Define variables */
    double a, b, c, x1, x2;
    double complex cx1, cx2;
    /* Ask for user input */
    printf("a = ");
    scanf("%lf", &a);
    printf("b = ");
    scanf("%lf", &b);
    printf("c = ");
    scanf("%lf", &c);
    /* Part (i) */
    x1 = -b + sqrt(b * b - 4 * a * c) / (2 * a);
    x2 = -b - sqrt(b * b - 4 * a * c) / (2 * a);
    printf("Roots\nx1 = %lf\nx2 = %lf\n", x1, x2);
    /* Part (ii) */
```

```
    cx1 = -b + csqrt(b * b - 4 * a * c) / (2 * a);
    cx2 = -b - csqrt(b * b - 4 * a * c) / (2 * a);
    printf("Complex Roots\nx1 = %lf\nx2 = %lf\n", cx1, cx2);
    return 0;
}
```

Chapter 17 exercise 6

```
/**
 * Compute a complex function and
 * its inverse.
 * Author: Nicolas Ventura
 */

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

complex double f(complex double z) {
    return z * z - 3.0;
}

complex double g(complex double z) {
    return csqrt(z + 3.0);
}

int main(void) {
    complex double fz, gz, z;
    /* Calculate the function f(z) */
    z = I * sqrt(2.0);
    fz = f(z);
    printf("f(z) = %lf\n", fz);
    /* Calculate the function g(z) */
    z = -5.0;
    gz = g(z);
    printf("g(z) = %lf\n", gz);
    return 0;
}
```

```
f(z) = complex(-5.000000,0.000000)
g(z) = complex(0.000000,1.414214)
```

Problem 7a

```
/**
 * Solve the complex equation.
 * Author: Nicolas Ventura
 */

#include <stdio.h>
#include <complex.h>

int main(void) {
    /* Knowns */
    double phi1 = M_PI / 2.0, r2 = 2.7;
```

```
    /* Known */
    complex double z = polar(sqrt(2.0), deg2rad(35.0));
    /* Unknowns */
    double r1_1, phi2_1, r1_2, phi2_2;
    /* Use complexsolvePR(...) */
    complexsolvePR(phi1, r2, z, r1_1, phi2_1, r1_2, phi2_2);
    /* Print solutions */
    printf("r1 = %7.4lfm, phi2 = %7.4lf rad = %7.4lf deg\n", r1_1,
    phi2_1, rad2deg(phi2_1));
    printf("r1 = %7.4lfm, phi2 = %7.4lf rad = %7.4lf deg\n", r1_2,
    phi2_2, rad2deg(phi2_2));
    return 0;
}
```

```
r1 = -1.6277m, phi2 =  1.1273 rad = 64.5922 deg
r1 =  3.2500m, phi2 = -1.1273 rad = -64.5922 deg
```

Problem 7b

```
/**
 * Solve the complex equation.
 * Author: Nicolas Ventura
 */

#include <stdio.h>
#include <complex.h>

int main(void)
{
    /* Knowns */
    double r1 = 1.0, r2 = sqrt(3.0);
    /* Known */
    complex double z = polar(2.7, deg2rad(45.0));
    /* Unknowns */
    double phi1_1, phi2_1, phi1_2, phi2_2;
    /* Use complexsolveRR(...) */
    complexsolveRR(r1, r2, z, phi1_1, phi2_1, phi1_2, phi2_2);
    /* Print solutions */
    printf("phi1 = %7.4lf rad = %7.4lf deg, phi2 = %7.4lf rad =
    %7.4lf deg\n", phi1_1, rad2deg(phi1_1), phi2_1, rad2deg(phi2_1)
    );
    printf("phi1 = %7.4lf rad = %7.4lf deg, phi2 = %7.4lf rad =
    %7.4lf deg\n", phi1_2, rad2deg(phi1_2), phi2_2, rad2deg(phi2_2)
    );
    return 0;
}
```

```
phi1 =  0.5832 rad = 33.4155 deg, phi2 =  0.9016 rad = 51.6578 deg
phi1 =  0.9876 rad = 56.5845 deg, phi2 =  0.6692 rad = 38.3422 deg
```