Part 1: Multiple Choice (66 points - 3 points per question)

(C) 1. Which is true?
   (A) Lines beginning with a # are processed at execution time.  (B) Omitting definition of a variable is a logic error.
   (C) Reading a value into a memory location destroy the previous value.  (D) none of the above

(C) 2. Which is true?
   (A) The division by zero is a compilation error.  (B) A compiler translates a program into machine instructions.
   (C) 1 is a valid variable name in C.  (D) none of the above

(D) 3. a, b, c, and d are 4 integers and and a = 2, b = 7, c = -5. What is the value of d after running d = b - a % c * a - ++c;
   (A) 9  (B) 10  (C) 11  (D) none of the above

(B) 4. Which statement is true?
   (A) > is a logical operator.  (B) += has the lower precedence than %.
   (C) ?: associates from left to right.  (D) none of the above

(D) 5. Which is not a control structure? (A) sequence structure (B) selection structure (C) repetition structure (D) flow structure

(B) 6. Which is a double-selection statement? (A) switch (B) if . . . else (C) while (D) none of the above

(C) 7. If x = -8 and y = 5, what is the value of y for y -= x - y < 3 ? x : ++y?
   (A) 11  (B) 12  (C) 13  (D) none of the above

(A) 8. If x = 6, what will be printed if executing the following code: if (x *= 2) printf("%d", x - 4);
   (A) 6  (B) 8  (C) 10  (D) none of the above

(D) 9. Which can be used to convert a lower case letter ch to a upper case?
   (A) ch += 'a' + 'A' (B) ch += 'a' - 'A' (C) ch -= 'A' - 'a' (D) none of the above

(C) 10. Which is equivalent to the expression if (n - 6 != 0)?
   (A) if !(n = 6) (B) if (n > 6 && n < 6) (C) if (n - 6) (D) none of the above

(C) 11. Assume a = 8 and b = 6, which of the following is true?
   (A) a > b & & b > 2 < a (B) a % b > a - b (C) b - a > -b % a (D) none of the above

(A) 12. How many times will the following program print hello? for (i = 2; i < 1000; i *= i) printf("hello");
   (A) 4  (B) 5  (C) 6  (D) none of the above

(C) 13. Which is the value of i after running i = 10; while (i-- >= 6);?  (A) 4  (B) 5  (C) 6  (D) none of the above

(C) 14. Which is the printf conversion specification for long int?
   (A) %lu (B) %lh (C) %ld (D) none of the above

(D) 15. Which is an invalid statement in C?
   (A) for (; i > 1, i < 10; i++) (B) for (; i < 10 ; ) (C) for (i = 0, j = 0; ;) (D) none of the above

(C) 16. Which is a benefit of functions?
   (A) Reduce programming errors (B) Make a program more efficient (C) Avoid code repetition (D) none of the above

(B) 17. a = 3, b = 6 and c = 8 are three integers then what is printed by printf("%.2f", ceil(sqrt(a * b /c + b + c)));
   (A) 3.00  (B) 4.00  (C) 5.00  (D) none of the above

(A) 18. Which method will return 3.0?  (A) floor(3.6)  (B) round(3.6)  (C) log10(10000)  (D) none of the above

(A) 19. Which function is used to seed a new random number sequence?  (A) srand (B) seed (C) rand (D) none of the above

(D) 20. How to generate a random number between -a and a?
   (A) a + rand() % a;  (B) -a + rand() % a;  (C) a - 2 * rand() % a;  (D) none of the above

(C) 21. A recursive function is a function that
   (A) is inside of another function (B) take itself as parameter (C) calls itself (D) returns itself

(A) 22. What value does function sum return when called with a value of 5?
   (A) 13  (B) 33  (C) 39  (D) none of the above

int sum (int n) {
   if (n < 1) return 1;
   else return n + sum(n - 1) + sum(n - 2) - n;
}

Part 2: Questions and Answers (48 points)

1. (10 points) Represent the following two equations in C programming language.
   (a) (3 points) \[ y = \sqrt{\sin^2 x + \cos^2 x}. \]
   (b) (3 points) \[ x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}. \]
   (c) (4 points) \[ x = \frac{a}{\sqrt{\frac{b}{a} - c}}. \] Hint: \texttt{fabs} is a function for the absolute value.

(a) \[ y = \sqrt{\sin(x) \times \sin(x) + \cos(x) \times \cos(x)} \]
(b) \[ x = -b + \sqrt{b^2 - 4 \times a \times c} / (2 \times a) \]
(c) \[ x = a / (\sqrt{a^2 + b \times b} / \texttt{fabs}(a - b)) \]
2. (8 points) Consider the following code that reads n and randomly generates n random integers and calculates the harmonic mean. Identify and correct the errors.

```c
int main (  
    int n;  
    double sum;  
    rand(getpid());  
    print("Input n: ");  
    scan("%f", n);  
    print("The random numbers are:
");  
    for (i = 1; i < n; i++) {  
        r = rand(getpid()) % 100 + 1;  
        print("%d ", r);  
        sum += 1.0/r;  
    }  
    print("The harmonic mean is %d.
", n/sum);  
}
```

```c
int main(void) {  
    int n, i, r;  
    double sum;  
    srand(getpid());  
    printf("Input n: ");  
    scanf("%d", &n);  
    printf("The random numbers are:
");  
    for (i = 0; i < n; i++) {  
        r = rand() % 100 + 1;  
        printf("%d ", r);  
        sum += 1.0/r;  
    }  
    printf("The harmonic mean is %f.
", n/sum);  
}
```

3. (10 points) Write the result after executing the following programs.

(a) (4 points)

```c
int main(void) {  
    int w = 0, x = 1, y = 2, z = 3;  
    switch(x) {  
        case 1: x *= 2; y = w++ + z;  
        case 2: w = x + y; break;  
        default: z += w % x ;  
    }  
    printf("w = %d, x = %d, y = %d, z = %d
", w, x, y, z);  
}
```

(b) (6 points)

```c
int main(void) {  
    int a = 3, b = -6, c;  
    c = a++ * b--;  
    c *= --a - ++b;  
    c = c % 3 ? a++ + --b : --a * b++;  
    printf("a = %d, b = %d, c = %d\n", a, b, c);  
}
```

Ans:

(a) w = 5, x = 2, y = 3, z = 3
(b) a = 2, b = -5, c = -12

4. (10 points) Write a program that reads three points and decides if a triangle can be formed or not. If the triangle can be formed, calculate the area of triangle.

Hint:

(a) The distance between \((x_1, y_1)\) and \((x_2, y_2)\) is \(\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}\).
(b) The area of the triangle is \( S = \sqrt{s(s-a)(s-b)(s-c)} \) where \( a, b, \) and \( c \) are three sides of the triangle and \( s = \frac{a+b+c}{2} \).

Ans:

```c
int main(void) {
    double x1, y1, x2, y2, x3, y3, a, b, c, s, area;

    printf("Enter the points (x1, y1), (x2, y2), and (x3, y3): ");
    scanf("%lf%lf%lf%lf%lf%lf", &x1, &y1, &x2, &y2, &x3, &y3);
    a = sqrt((x1 - x2) * (x1 - x2) + (y1 - y2) * (y1 - y2));
    b = sqrt((x1 - x3) * (x1 - x3) + (y1 - y3) * (y1 - y3));
    c = sqrt((x2 - x3) * (x2 - x3) + (y2 - y3) * (y2 - y3));
    if (a + b > c && a + c > b && b + c > a) {
        s = (a + b + c)/2;
        area = sqrt(s * (s - a) * (s - b) * (s - c));
        printf("The area of the triangle is %f.\n", area);
    } else printf("The triangle cannot be formed.\n");
}
```

5. (10 points) Write a program that reads \( x \) and \( n \) and calculate the following series: \( 1 - \frac{x}{1!} + \frac{x^2}{2!} - \cdots + (-1)^n \frac{x^n}{n!} \).

Ans:

```c
int main(void) {
    double x, t = 1, s = 1, f = 1;
    int i, n;

    printf("Enter x and n: ");
    scanf("%lf%d", &x, &n);
    for (i = 1; i <= n; i++) {
        t *= -x;
        f *= i;
        s += t/f;
    }
    printf("The series sum is %lf.\n", s);
}
```