Problem One - Program Execution (10 points each)

```fortran
integer i,j,k,m,n,mm
real a,b,c,d
a=26./5/2 + 26/5/2.
b=11/3*3 + 11/(3*3)
i=a/2*2
j=(i+6)/i
k=i+4 / j+4
m=3**2**3
C=-2.*j/i
d=1+1/3+1/5
mm=1.+1./3.+1./5.
n=(k-1)/k
write (*,*) i,j,k,m,n,mm
write (*,*) a,b,c,d
end
```

The output values of the programs are

- i = __________
- j = __________
- k = __________
- m = __________
- n = __________
- mm = __________
- a = __________
- b = __________
- c = __________
- d = __________

Problem Two - Fortran Arithmetic Expression (15 points)

Write the following algebraic expression in one or more Fortran statements. Assume the variables are already specified earlier and the values are stored previous to the present expression. You may use extra temporary variables to shorten the expressions. Generally, it is a better programming practice to write short algebraic expressions.

\[
q = \frac{1}{3} \left( \frac{(f^2 + g^2)f + 3h^2}{2a + 3b} \right) + \frac{4}{3} (a + 2c + bcd) + \frac{1}{2} \left( \frac{\tan^{-1}(3c) \cos 2b}{6d + [3e + 2(3 + e)]} \right)
\]
Problem Three - Recurrence Relationship of Mathematical Series (15 points)

Consider the following mathematical power series:

\[
g(x) = \int \frac{1}{x} \log \left( \frac{x}{a} + \sqrt{\frac{x^2}{a^2} + 1} \right) \, dx = T_1 + T_3 + T_5 + T_7 + \ldots
\]

\[
= \frac{x}{a} - \frac{1}{2 \cdot 3 \cdot 3} \frac{x^3}{a^3} + \frac{1 \cdot 3}{2 \cdot 4 \cdot 5 \cdot 5} \frac{x^5}{a^5} - \frac{1 \cdot 3 \cdot 5}{2 \cdot 4 \cdot 6 \cdot 7 \cdot 7} \frac{x^7}{a^7} + \ldots
\]

find its recurrence relationship \( f(i, x) = T_i / T_{i-2} \), for \( i = 3, 5, 7, \ldots \).

Problem Four - C Programming (20 points)

The equally spaced interpolation formula for \( g \) can be written as

\[
g = f_1 + s \Delta f_1 + \frac{s(s - 1)}{2} \Delta^2 f_1
\]

in which \( s = (x - x_1)/h, h = (x_2 - x_1) \) or \( (x_3 - x_2) \), \( \Delta f_1 = f_2 - f_1 \) and \( \Delta^2 f_1 = f_3 - 2f_2 + f_1 \). Write a C program which will prompt for 7 values: \( x, x_1, x_2, x_3, f_1, f_2 \) and \( f_3 \), calculate the solutions for \( g \) and output the results to the console.
Problem Five - FORTRAN Programming (20 points)

Given the mathematical power series:

\[ f(x) = \ln \left[ \frac{1 + \sqrt{1 + x^2}}{2} \right] = T_2 + T_4 + T_6 + T_8 + \ldots \]
\[ = \frac{1 \cdot 1}{2 \cdot 2} x^2 - \frac{1 \cdot 1 \cdot 3}{2 \cdot 4 \cdot 4} x^4 + \frac{1 \cdot 1 \cdot 3 \cdot 5}{2 \cdot 4 \cdot 6 \cdot 6} x^6 - \frac{1 \cdot 1 \cdot 3 \cdot 5 \cdot 7}{2 \cdot 4 \cdot 6 \cdot 8 \cdot 8} x^8 + \ldots, \]

with its recurrence relationship given as

\[ f(i, x) = \frac{T_i}{T_{i-2}} = -\frac{(i - 2)(i - 1)}{i^2} x^2 \]

for \( i = 4, 6, 8, \ldots \) Write a FORTRAN program to prompt the user for a value of \( x \) and then sum the first 10 terms of the series.
Problem Six - Program Debugging (10 points)

Find any 5 errors from the 2 programs listed below; explain why it is an error. (There are many more than 3 errors included.)

```plaintext
open(10, file='get.dat', status='old')
real a, b, c
write (10, *) a, b, c
a=1.4
b=-a**2
c=14.2*sqrt(b)
end

#include <stdio.h>
main()
{ float a, b, c; int i, j, k;
a=3.0;
scanf("%", b);
c=-a*b;
d=a**(i/j);
b=sin(d);
printf("%f %f\n", c, k);
}
```