

Issue date: Tuesday 4th November 2008

Hand-in date: Friday 14th November 2008 (**12 noon**)

Part 1. Fibonacci Sequence (10 marks)

Write a program that will, for any positive integer N input by the user, output the Fibonacci sequence

1, 1, 2, 3, 5, ...

up to, but not exceeding, N . (The sequence should be computed recursively; i.e. each term is the sum of the previous two terms.)

Include in your report a full program listing, together with the output for $N = 1000$.

Part 2. Power Series (15 marks)

Write a function that will return $\sin^{-1} x$ by summing the following power series:

$$\arcsin(x) = \sum_{n=0}^{\infty} \frac{(2n)!}{2^{2n} (n!)^2 (2n+1)} x^{2n+1}, \quad |x| < 1$$

Include also a test program that will invoke this function for a user-specified value of x and compare results with the standard Fortran intrinsic function ASIN.

Include in your report a full program listing, together with the results of your power-series evaluations for the following values of x :

0.5
-0.8,
0.999

Part 3. Vectors and Matrices (15 marks)

Write separate functions or subroutines to calculate the scalar and vector products of two 3-dimensional vectors and a subroutine to calculate the determinant of a 3×3 matrix.

Write suitable test programs to input vectors or matrices and invoke your scalar-product, vector-product and determinant routines. (Input should be at run-time, not hard-wired in code). Do *not* use the standard intrinsic function DOT_PRODUCT to find the scalar product!!

Include in your report full program listings (including test programs), together with the program's output for the following:

scalar product of (1.5, 3.7, -1.5) and (3.2, 5.0, -2.7)

vector product of (1.5, 3.7, -1.5) and (3.2, 5.0, -2.7)

determinant of $\begin{bmatrix} 2 & 4 & -3 \\ 1.5 & 3.5 & 1.7 \\ -3 & -4.3 & -6 \end{bmatrix}$