

## SUPPLEMENTARY PROGRAMMING PROBLEMS

1. Write a Fortran program, `DIETEST`, to simulate the throw of a dice using the `RANDOM_NUMBER` subroutine. The program should also check the distribution of random numbers produced and use this to assess whether your dice-throwing simulation produces a fair result.

2. Write a Fortran program, `PRIME`, to determine whether a given integer is a prime number, then use it to find whether the number 1155044167 is a prime number or a product of two prime numbers other than 1. Further, produce a second program, `PRIME2`, which may be used to determine the number of prime numbers below any given integer. Use your program to determine the total number of prime numbers up to and including the prime number 89293.

3. Write a Fortran program, `SERIES`, to return an approximate value for  $\exp(x)$  using the series expansion

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \cdots$$

If  $N$  is the number of terms in the above series, find the minimum value of  $N$  required in order to reduce the fractional error in your value of  $\exp(x)$  to less than  $1 \times 10^{-12}$  given that the maximum value of  $x$  is 50.