

SEMESTER 2 (SUMMER) EXAMINATIONS 1998-99

3<sup>rd</sup> year B. Sc. (CS313 unit)

CS313: High Level Language Programming for Computational Physics

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Answer TWO questions

Time allowed: ONE and a HALF hours

Q.1 Give a detailed description of the different types of looping structures available in QBasic.

A ball is released from the edge of a cliff and allowed fall to the ground below. In addition to the action of gravity on the ball, a viscous drag force opposes the motion of the ball. A program is to be written to model the motion of the ball using Euler integration. The program is to be used to determine the velocity of the ball to a required precision a fixed time after the ball is released. Briefly outline the most appropriate looping structures for use in this program giving reasons for your choices.

Q.2 Answer *both* (a) and (b).

(a) Give a brief description of the different types of variable available for the storage of numbers in QBasic. Outline two problems, which can occur due to the non-exact storage of floating point numbers, and suggest how these problems may be best avoided.

(b) What properties are required of a good random number generator? Describe how the "*Hit and Miss*" and "*Sample Mean*" Monte Carlo techniques are used to evaluate integrals.

Q.3 Construct a pair of differential equations which describe the motion, in two dimensions, of the following systems:

- (i) a projectile in the case where the drag force is proportional to the square of the velocity,
- (ii) a classical electron orbiting a proton.

Briefly describe how a numerical method could be used to model the behaviour of either system.