

REVIEW - CHAPTER 1

- 1.12. What three properties characterize a well-posed problem?
- 1.13 List three sources of error in scientific computation. Explain the distinction between:
- 1.14. (a) truncation (or discretization) and rounding,
- 1.15. (b) absolute error and relative error,
- 1.16. (c) computational error and propagated data error,
- 1.17. (d) precision and accuracy,
- 1.22. (e) forward and backward error,
- 1.24. (f) how are forward and backward error related to each other?

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- 1.18. (a) What is meant by the *conditioning* of a problem?
- Is it affected by:
- (b) the algorithm used to solve the problem?
- (c) the precision of the arithmetic used to solve the problem?
- 1.36. (a) Give an example to show that floating-point addition is not necessarily associative.
- (b) Give an example to show that floating-point multiplication is not necessarily associative.

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- 1.37.(a) In what circumstances does cancellation occur in a floating-point system?
- (b) Does it imply that the true result of the specific operation causing it is not exactly representable in the floating-point system?
- (c) Why is cancellation usually bad?
- 1.49. Explain why an alternating infinite series, such as: $e^x = 1 + x + x^2/2! + x^3/3! + \dots$ for $x < 0$, is difficult to evaluate accurately in floating-point arithmetic.

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- 1.44. (a) Explain the difference between the unit roundoff (ϵ_{mach}), and the underflow level, (UFL).
- Which one of these two quantities,
- (b) depends only on the number of digits in the mantissa field?
- (c) depends only on the number of digits in the exponent field?
- (d) does *not* depend on the rounding rule used?
- (e) is *not* affected by allowing subnormal numbers?

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- 1.47. (a) Explain why a divergent infinite series, such as: $\sum (1/n)$, $n=1 \dots \infty$ can have a finite sum in floating-point arithmetic.
- (b) At what point will the partial sums stop to change?

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- 1.42. Assume a decimal (base 10) floating-point system having machine precision $\epsilon=10^{-5}$ and an exponent range of ± 20 . What is the result of each of the following floating-point arithmetic operations?
- (a) $1 + 10^{-7}$
- (b) $1 + 10^3$
- (c) $1 + 10^7$
- (d) $10^{10} + 10^3$
- (e) $10^{10}/10^{-15}$
- (f) $10^{-10} \times 10^{-15}$