MA203 NUMERICAL METHODS

TUTORIAL SHEET 1
(Session: MO/23)

MODULE 1 **TOPIC: ERRORS**

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1. Determine the number of significant digits in each of the following:
   (a) 3.405
   (b) 0.00289
   (c) 1030
   (d) 7.0040×10^{-3}
   (e) 102.00
   (f) 0.000980
   (g) 9.80
2. What do you mean by normalized floating point representation of numbers? Express the number 44.85×10^6 in normalized floating point form.
3. Using normalized floating point arithmetic, perform the following operations considering rounding off the numbers:
   (a) $.4546E03 + 0.5454E08$
   (b) $.5452 \times 10^{-3} + 0.9432 \times 10^{-4}$
   (c) $.7288E05 - .7284E05$
   (d) $.5334 \times 10^9 + 0.1132 \times 10^{-25}$
4. Determine the five-digit (a) chopping and (b) rounding values of the irrational number π .
5. Prove the following consequence of the normalized floating point representation in $4-$ digit mantissa standard form with chopping
   $$4x \neq (x + x) + x) + x)$$
   where $x = .6667$
6. Discuss the possible sources of error that are frequently encountered while dealing with numerical methods.
7. If the true value $x_t = \frac{10}{3}$ and approximate value $x_a = 3.33$, then check it is correct up to how many decimal places and significant digits.
8. If $\pi = \frac{22}{7}$ is approximated as 3.14. Find the absolute, relative, and percentage errors.
9. Evaluate the sum $S = \sqrt{3} + \sqrt{5} + \sqrt{7}$ to four significant digits and find its absolute and relative error.
10. The solution of a problem is given as 4.536. It is known that the absolute error in the solution is less than 0.01. Find the interval within which the exact value will lie.
11. Given the solution of a problem as $x_a = 35.25$ with relative error in the solution at most 2%. Find to four decimal digits, the range of values within which the exact value of the solution must lie.

12. Round off the number 75462 to four significant digits and then, compute the absolute error and percentage error.

13. Three approximate values of $\frac{1}{3}$ are given as 0.30, 0.33, and 0.34. Which of the three is the best approximation?

14. If $x = 0.005998$, find the relative error when x is

    (a) rounded off to three decimal digits

    (b) truncated(chopped) to three decimal digits

    with normalized floating point form.

15. If $r = 3h(h^6 - 2)$, then obtain the percentage error in r at $h = 1$, if the percentage error in h is 5%.

16. Compute the percentage error in $u = 2v^6 - 5v$ at $v = 1$, if the error in $v = 0.05$.