

CSE 541 Sample Questions

Note: it is NOT sufficient to study just these sample questions.

- What would be the outcome if 1.2345 is rounded to 4 significant digits?
 - What would be the outcome if 1.234501 is rounded to 4 significant digits?
- Show how $(-1000011111)_2$ would be represented in single precision IEEE floating point format.
- What would be the outcome of $2^{15} + 2^{-15}$ in a 32-bit single-precision machine?
- What is the smallest number greater than 1.0 that can be represented in a 32-bit machine?
- If $x \approx 1.1$ and $y \approx 1.12$, then $x + y \approx$ _____.
 - If $x = 1.1$ and $y \approx 1.12$, then $x + y \approx$ _____.
- Let $x = 12.48003147$. Let $y = 12.47993127$ be an approximation to x .
 - How many significant digits does y have?
 - To how many significant digits does y approximate x ?
- Consider evaluating the function $f(x) = 5 - \sqrt{x^4 + 25}$ by first evaluating $\sqrt{x^4 + 25}$ and then subtracting it from 5. For what values of x is this a problem and why?
 - Give a numerically better way of calculating $f(x)$.
- True or false: if we use Newton's method to compute \sqrt{R} (by solving the equation $x^2 = R$), then the sequence of iterates is defined by

$$x_{n+1} = \frac{1}{2} \left(x_n + \frac{R}{x_n} \right)$$

Justify your answer.

- Assume that $f(0)$ and $f(1)$ have different signs, and we want to find a zero of f using the bisection method. Approximately how many iterations are needed to find a most accurate solution in a single-precision machine?
- True or false: Newton's method for root finding approximately doubles the number of correct digits per iteration if the sequence converges.
- It is suspected that the table

x	-2	-1	0	1	2	3
y	1	4	11	16	13	-4

comes from a cubic polynomial. How can this be tested? Explain.

- Give the polynomial in Lagrange's form that interpolates the following table:

x	1	2	3	4	5
y	0	0	0	6	8

Do not simplify the polynomial.

13. The polynomial $p(x) = x^4 - x^3 + x^2 - x + 1$ has the following values:

x	-2	-1	0	1	2	3
$p(x)$	31	5	1	1	11	61

Find a polynomial q that takes these values:

x	-2	-1	0	1	2	3
$q(x)$	31	5	1	1	11	20

Do not simplify the polynomial.

14. Let

$$S(x) = \begin{cases} x^3 + 3x^2 + 7x - 5 & (-1 \leq x \leq 0) \\ -x^3 + 3x^2 + 7x - 5 & (0 \leq x \leq 1) \end{cases}$$

- (a) Is S a cubic spline? Justify your answer.
(b) Is S a natural cubic spline? Justify your answer.