Sample Lecture Slides

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- **Example of clicker question types:**
  - `\qitemMCthree`
  - `\qitemMCfour`
  - `\qitemMCfive`
  - `\qitemTF`
- **Note that the clicker slides are not included in the slide numbering.**

Clicker Question #25

You have a system of three linear equations with three unknowns. If you perform Gaussian elimination and obtain the reduced row echelon form

$$\left[\begin{array}{ccc|c} 1 & -2 & 4 & 6 \\ 0 & 1 & 0 & -3 \\ 0 & 0 & 0 & 0 \end{array}\right]$$

then the system has . . .

(A) no solution

(B) a unique solution

(C) more than one solution

(D) infinitely many solutions

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(D) infinitely many solutions

Answer: (D). The last equation reads "$0 = 0$" so x_3 can be any real number. Strictly (C) is also correct, but (D) is the most accurate answer.

Clicker Question #26

Fill in the blank: If $f(x)$ is a real-valued function of a real variable, then the ____________ error in the difference approximation for the derivative $f'(x) \approx \dfrac{f(x+h) - f(x)}{h}$ goes to zero as $h \to 0$.

(A) absolute

(B) relative

(C) cancellation

(D) truncation

Clicker Question #26

Fill in the blank: If $f(x)$ is a real-valued function of a real variable, then the ____________ error in the difference approximation for the derivative $f'(x) \approx \dfrac{f(x+h) - f(x)}{h}$ goes to zero as $h \to 0$.

(A) absolute

(B) relative

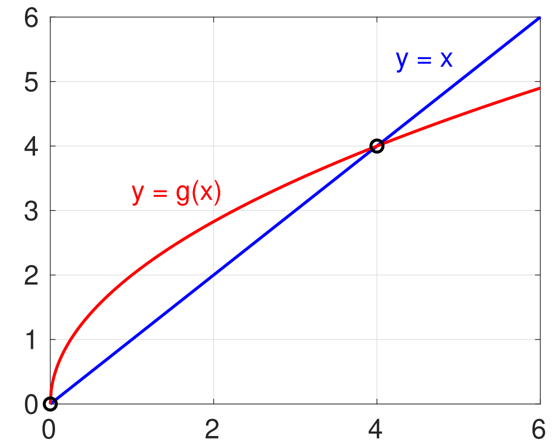
(C) cancellation

(D) truncation

Answer: (D). Strictly, response (A) is also correct since truncation error is an (absolute) difference from the exact derivative.

Clicker Question #27

The intersection points between the curves $y = x$ and $y = g(x)$ are $x = 0$ and $x = 4$, as shown in the plot. Which of the statements below regarding the fixed point iteration $x_{k+1} = g(x_k)$ is TRUE?



I. If $x_0 = 2$ then x_k converges to 4.

II. If $x_0 = 1$ then x_k converges to 0.

III. If $x_0 = 6$ then x_k converges to 4.

(A) I and II

(B) II and III

(C) I and III

(D) I, II and III

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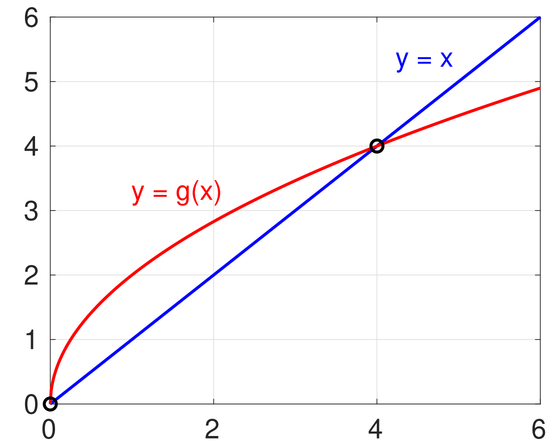

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(C) I and III

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Answer: (C).

Clicker Question #28

Consider the matrix

$$\mathbf{A} = \begin{bmatrix} 4 & -8 & 1 \\ 6 & 5 & 7 \\ 0 & -10 & -3 \end{bmatrix}$$

whose LU factorization we want to compute using Gaussian elimination. What will the initial pivot element be without pivoting, and with partial pivoting?

(A) 0 (no pivoting), 6 (partial pivoting)

(B) 4 (no pivoting), 0 (partial pivoting)

(C) 4 (no pivoting), 6 (partial pivoting)

Clicker Question #28

Consider the matrix

$$\mathbf{A} = \begin{bmatrix} 4 & -8 & 1 \\ 6 & 5 & 7 \\ 0 & -10 & -3 \end{bmatrix}$$

whose LU factorization we want to compute using Gaussian elimination. What will the initial pivot element be without pivoting, and with partial pivoting?

(A) 0 (no pivoting), 6 (partial pivoting)

(B) 4 (no pivoting), 0 (partial pivoting)

(C) 4 (no pivoting), 6 (partial pivoting)

Answer: (C).

Clicker Question #29

Which of the following statements is TRUE?

I. Simpson's rule is exact for linear functions, $f(x) = ax + b$.

II. Simpson's rule is exact for second-degree polynomials (quadratics), $f(x) = ax^2 + bx + c$.

III. Simpson's rule is exact for fourth-degree polynomials.

(A) none is true

(B) I

(C) II

(D) I and II

(E) I, II and III

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III. Simpson's rule is exact for fourth-degree polynomials.

(A) none is true

(B) I

(C) II

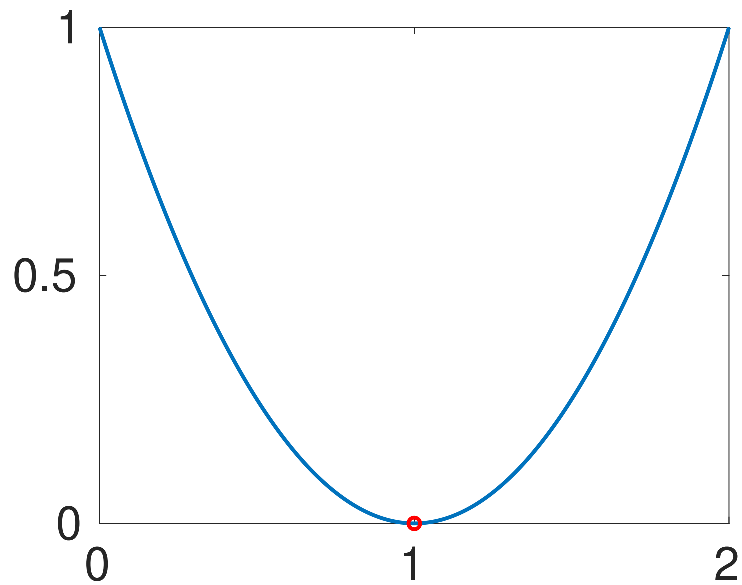
(D) I and II

(E) I, II and III

Answer: (D).

Clicker Question #30

True (A) or False (B): Let $f(x) = x^2 - 2x + 1$. The bisection method can be used to approximate the root of the function $f(x)$ pictured.



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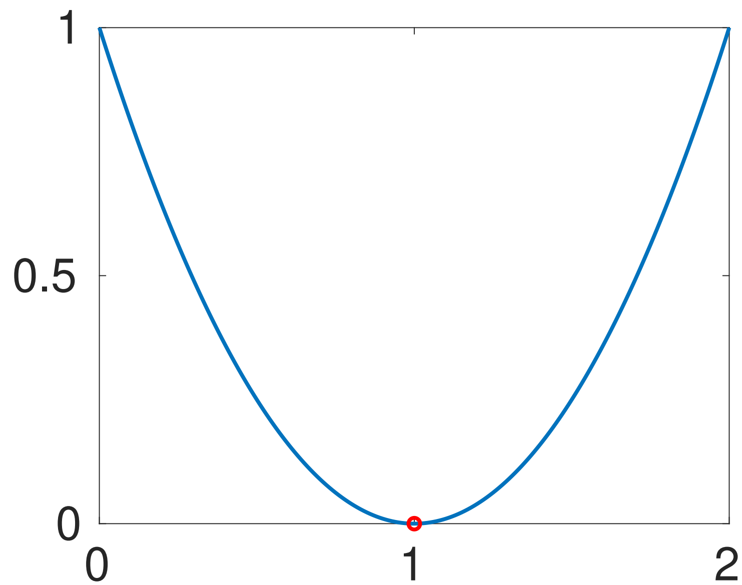

Answer: FALSE.

Clicker Question #31

True (A) or False (B): This piecewise polynomial is a quadratic spline:

$$S(x) = \begin{cases} 0, & \text{if } -1 \leqslant x \leqslant 0 \\ x^2, & \text{if } 0 \leqslant x \leqslant 1 \end{cases}$$

Clicker Question #31

True (A) or False (B): This piecewise polynomial is a quadratic spline:

$$S(x) = \begin{cases} 0, & \text{if } -1 \leqslant x \leqslant 0 \\ x^2, & \text{if } 0 \leqslant x \leqslant 1 \end{cases}$$

Answer: TRUE. The piecewise functions are both quadratic, and $S(x)$ and $S'(x)$ match at $x = 0$.