King Fahd University of Petroleum and Minerals
Information Technology Center
Computing Services Section

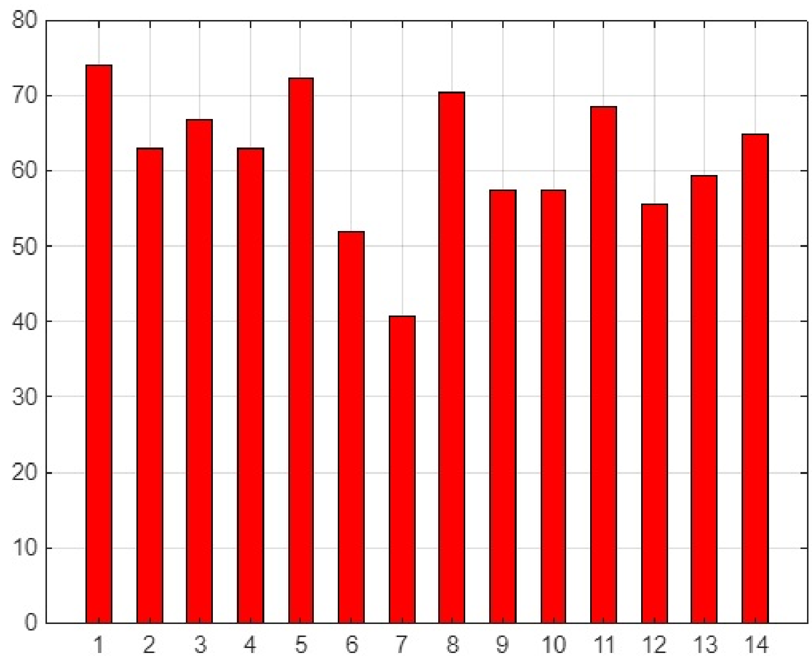
Dept. of: Math
Course: math371 Second Maior Exam
Semseter: 242

Tuesday, April 15, 2025

			Raw Score	% Score
Total no. of Students:	54	**Course Mean:**	43.24	61.77
Course Std. Dev. :	13.5	**Max. Score:**	70	100
		Min. Score:	15	21.43

Average (%) of each question

Q1	74.0741
Q2	62.963
Q3	66.6667
Q4	62.963
Q5	72.2222
Q6	51.8519
Q7	40.7407
Q8	70.3704
Q9	57.4074
Q10	57.4074
Q11	68.5185
Q12	55.5556
Q13	59.2593
Q14	64.8148



Question with highest average
Q1

Question with lowest average
Q7

1. Consider the differential equation: $(1+t^4)y' + 4t^3 y = 4t^3 \tan^{-1}(y), \quad 0 \le t \le 1$. Given that $y' = f(t,y)$, then

   (a) f satisfies Lipschitz condition with Lipschitz constant 2. ________ (correct)

   (b) f satisfies Lipschitz condition with Lipschitz constant 3/2.

   (c) f satisfies Lipschitz condition with Lipschitz constant 1.

   (d) f satisfies Lipschitz condition with Lipschitz constant 1/2.

   (e) f does not satisfy Lipschitz condition.

no students = 54
Average = 74.0741 %

2. Consider the initial value problem: $y' = 1 + y/t, \quad 1 \le t \le 2$, with $h = 0.25$, with exact solution $y(t) = t\ln(t) + 2t$. If the Euler's method is used to approximate the solution, then the least bound for $|y(1.75) - w_3|$ is

   (a) 0.139625 ________ (correct)

   (b) 0.138715

   (c) 0.140231

   (d) 0.143923

   (e) 0.129271

no students = 54
Average = 74.0741 %

3. Consider the initial value problem: $y' = te^{3t} - 2y, \quad 0 \le t \le 1, \quad y(0) = 0$, with $h = 0.5$, and exact solution $y(t) = \frac{1}{5}te^{3t} - \frac{1}{25}e^{3t} + \frac{1}{25}e^{-2t}$. If the midpoint method is used to approximate the solution, then the absolute error between the exact and approximate solutions at $t = 1$ is:

   (a) 0.0891 ______________________________ (correct)

   (b) 0.0872

   (c) 0.0914

   (d) 0.0926

   (e) 0.0792

no students = 54
Average = 66.6667 %

4. Consider the initial value problem: $y' = 1 + (t - y)^2, \quad 2 \le t \le 3, \quad y(2) = 1$, with $h = 0.5$. If the Runge-Kutta of order four is used to approximate the solution, then $y(2.5) \approx$

   (a) 1.8333 ______________________________ (correct)

   (b) 1.8103

   (c) 1.8204

   (d) 1.8422

   (e) 1.8037

no students = 54
Average = 62.9630 %

5. The linear system $\begin{cases} 2x_1 - 6\alpha x_2 = 3, \\ 6\alpha x_1 - 2x_2 = 3, \end{cases}$ has a unique solution if

(a) $\alpha \neq \mp 1/3$ ________________ (correct)

(b) $\alpha \neq \mp 1/2$

(c) $\alpha \neq \mp 1$

(d) $\alpha \neq -1$

(e) $\alpha \neq 1$

no students = 54
Average = 72.2222 %

6. If the Gaussian elimination with partial pivoting and three digit rounding arithmetic is used to solve the linear system $\begin{cases} 0.03x_1 + 58.9x_2 = 59.2, \\ 5.31x_1 - 6.10x_2 = 47.0, \end{cases}$ then $x_1 + x_2 =$

(a) 11 ________________ (correct)

(b) 10

(c) 9

(d) 8

(e) 12

no students = 54
Average = 74.0741 %

7. The row interchanges required to solve the linear system, $\begin{cases} 2x_1 - 3x_2 + 2x_3 = 5, \\ -4x_1 + 2x_2 - 6x_3 = 14, \\ 2x_1 + 2x_2 + 4x_3 = 8, \end{cases}$ using Gaussian elimination with partial pivoting is/are

(a) Interchange rows 1 and 2, then interchange rows 2 and 3. ________________(correct)
(b) No row interchanges are required.
(c) Interchange rows 1 and 3, then interchange rows 2 and 3.
(d) Interchange rows 1 and 2 only.
(e) Interchange rows 2 and 3 only.

no students = 54
Average = 40.7407 %

8. Consider the linear system $A\mathbf{x} = \mathbf{b}$, $\begin{cases} 2x_1 + x_2 - x_3 = 1, \\ -4x_1 + 2x_2 + 4x_3 = 0, \\ 6x_1 + 3x_2 + 2x_3 = -5. \end{cases}$ If the coefficient matrix A is expressed in LU form and $L\mathbf{y} = \mathbf{b}$ is solved for $\mathbf{y} = \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix}$. Then $y_1 + y_2 - y_3 =$

(a) 11 ____(correct)
(b) 9
(c) -8
(d) -5
(e) -6.5

no students = 54
Average = 70.3704 %

9. Consider a (4×4) matrix A. If performing Gaussian elimination on A requires interchanging row 1 with row 4, and then row 4 with row 2. If P is the permutation matrix such that A can be factored into the product LU, then $P^{-1} =$

(a) $\begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix}$ ________________ (correct)

(b) $\begin{bmatrix} 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix}$

no students = 54
Average = 57.4074 %

(c) $\begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 \end{bmatrix}$

(d) $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix}$

(e) $\begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$

10. If the following system is solved using Jacobi iterative method, $\begin{cases} 10x_1 - x_2 = 9, \\ -x_1 + 10x_2 - 2x_3 = 7, \\ -2x_2 + 10x_3 = 6, \end{cases}$

with $\mathbf{x}^{(0)} = (1, 1, 1)^t$. then $x_1^{(2)} + x_2^{(2)} + x_3^{(2)} =$

(a) 2.76 ________________ (correct)

(b) 2.65

no students = 54
Average = 57.4074 %

(c) 3.07

(d) 4.15

(e) 2.45

11. If the following system is solved using Gauss-Seidel iterative method,

$$\begin{cases} 3x_1 - x_2 + x_3 = 1, \\ 3x_1 + 6x_2 + 2x_3 = 0, \\ 3x_1 + 3x_2 + 7x_3 = 4, \end{cases} \quad \text{with } \mathbf{x}^{(0)} = (2, 1, 3)^t. \text{ Then } x_2^{(2)} =$$

(a) -0.2063 ________________________________ (correct)

(b) -0.3011

(c) -0.3193

(d) -0.2201

(e) 0.1231

no students = 54
Average = 68.5185 %

12. If the system $\begin{cases} x_1 + 2.5x_2 = 1, \\ 2.5x_1 + 3x_2 = 5, \end{cases}$ is solved using Conjugate Gradient method with $\mathbf{x}^{(0)} = (0, 0)^t$. Then $x_1^{(2)} + x_2^{(2)} =$

(a) 2.1538 ________________________________ (correct)

(b) 2.3842

(c) 1.9362

(d) 1.7851

(e) 3.0478

no students = 54
Average = 74.0741 %

13. If $A = \begin{bmatrix} 0 & 2 \\ 2 & 3 \end{bmatrix}$, then $||A||_2 =$

(a) 4 ____ (correct)

(b) 1

(c) 2.5

(d) 3.5

(e) 5

no students = 54
Average = 59.2593 %

14. The following linear system $A\mathbf{x} = \mathbf{b}$, $\begin{cases} \frac{1}{2}x_1 + \frac{1}{3}x_2 = \frac{1}{63}, \\ \frac{1}{3}x_1 + \frac{1}{4}x_2 = \frac{1}{168}, \end{cases}$ has $\mathbf{x}$ as the actual solution and $\tilde{\mathbf{x}} = (0.142, -0.166)^t$ as an approximate solution. Then $||A\tilde{\mathbf{x}} - \mathbf{b}||_\infty =$

(a) 0.000206 ____ (correct)

(b) 0.000213

(c) 0.0001998

(d) 0.000191

(e) 0.000341

no students = 54
Average = 64.8148 %