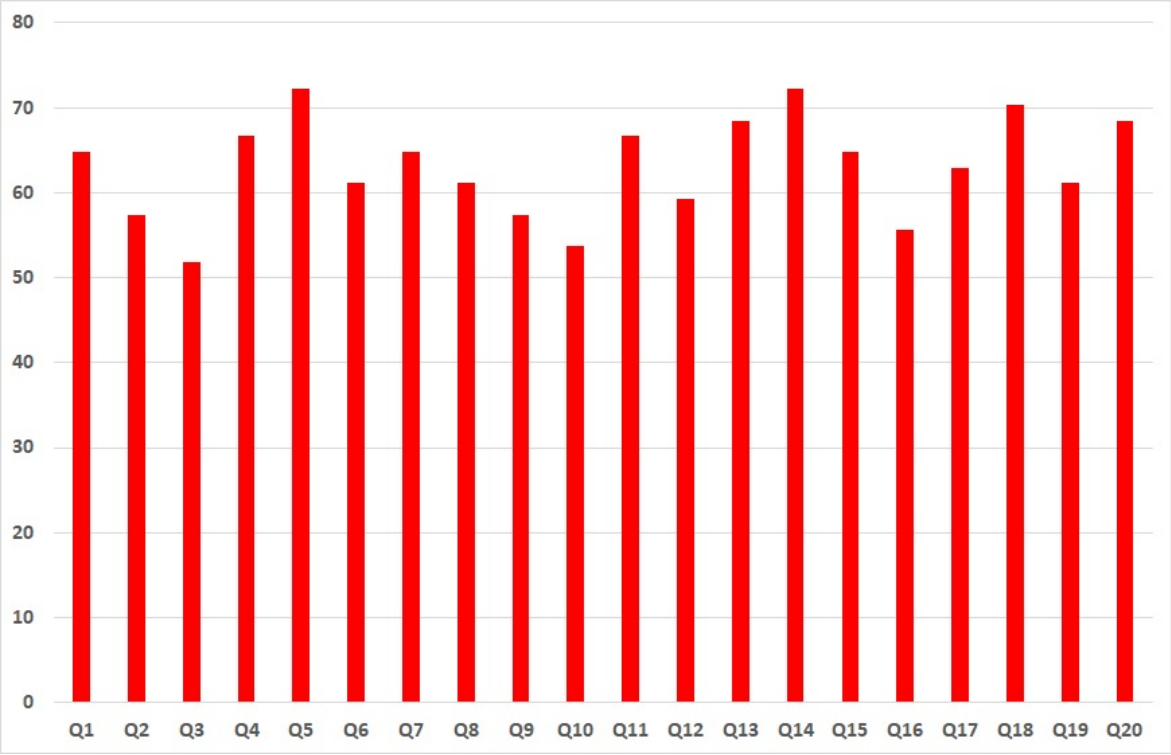
King Fahd University of Petroleum and Minerals
Information Technology Center
Computing Services Section

Dept. of: Math
Course: MATH371 Final Exam
Semseter: 242

Monday, May 26, 2025

			Raw Score	% Score
Total no. of Students	46	**Course Mean:**	74.02	74.02
Course Std. Dev. :	21.36	**Max. Score:**	100	100
		Min. Score:	25	25

Q	Average
Q1	64.8148
Q2	57.4074
Q3	51.8519
Q4	66.6667
Q5	72.2222
Q6	61.1111
Q7	64.8148
Q8	61.1111
Q9	57.4074
Q10	53.7037
Q11	66.6667
Q12	59.2593
Q13	68.5185
Q14	72.2222
Q15	64.8148
Q16	55.5556
Q17	62.963
Q18	70.3704
Q19	61.1111
Q20	68.5185



1. Use a fixed-point iteration to determine a solution for $x^4 - 3x^2 = 3$ on $[1, 2]$. Use $P_0 = 1$ and $g(x) = (3x^2 + 3)^{\frac{1}{4}}$ then $P_2 =$

(a) 1.7936 (correct)

(b) 1.5661

(c) 1.8391

(d) 1.9321

(e) 1.6531

Average:

64.8148

2. Use the secant method to approximate the solution of $ln(x - 1) + \cos(x - 1) = 0$. Let $p_0 = 1.3$ and use the Newton's Method to find p_1 then p_2 of the secant method is equal to

(a) 1.3951 (correct)

(b) 1.4952

(c) 1.3251

(d) 1.3015

(e) 1.4932

Average:

57.4074

3. Construct the Lagrange interploating polynomial for the function $f(x) = \ln(x+1)$ on $[0, 2]$ using the nodes $x_0 = 0$, $x_1 = 1$, $x_2 = 2$ then $f(1.5) \approx$

(a) 0.9318 (correct)

(b) 0.8131

(c) 0.8031

(d) 0.9831

(e) 0.9732

Average:

51.8519

4. Let $f(x) = x \sin x - \cos x$. Using the most accurate three-points formula and $h = 0.4$, then $f'(1.9) \approx$

(a) 1.1949 (correct)

(b) 1.3949

(c) 1.5949

(d) 1.4919

(e) 1.1210

Average:

66.6667

5. The smallest value of n required to approximate $\int_{-4}^{0} xe^x\,dx$ by Composite Trapezoidal to within 10^{-2} is

(a) 33 (correct)
(b) 30
(c) 35
(d) 30
(e) 31

Average:

72.2222

6. Consider the following initial-value problem

$$\frac{dy}{dt} - 1 = \frac{y}{t},\ 1 \le t \le 2,\ y(1) = 2$$

Use midpoint method with $h = 0.5$, then $y(2) \approx$

(a) 5.3714 (correct)
(b) 6.3714
(c) 5.9371
(d) 6.3551
(e) 5.9321

Average:

61.1111

61.1111

7. Consider the linear system

$$\begin{aligned} x_1 + x_2 + 3x_3 &= 0 \\ 2x_1 - x_2 + x_3 &= -1 \\ 3x_1 + 3x_2 + 5x_3 &= 4 \end{aligned}$$

in matrix form $AX = b$ and $A = LU$ is LU factorization,then the solution for $LY = b$ is

(a) $(0, -1, 4)$ (correct)

(b) $(1, 1, 4)$

(c) $(0, 1, 5)$

(d) $(1, 0, 4)$

(e) $(2, -1, 4)$

Average:

64.8148

8. The first iteration of the Gauss-Seidel method for the following system is $(x_1^{(1)}, x_2^{(1)}, x_3^{(1)})$, with $x^{(0)} = (0, 0, 0)^t$, then $x_3^{(1)} =$

$$\begin{aligned} -x_1 \qquad + 2x_3 &= 3 \\ 2x_1 - 1.5x_2 + 3x_3 &= 1 \\ 4x_1 - 4.5x_2 + 5x_3 &= 1 \end{aligned}$$

Average:

61.1111

(a) -1.6 (correct)

(b) -1.4

(c) -1.3

(d) -1.0

(e) 2.1

61.1111

9. Suppose that

$$\begin{aligned} -x + By - z &= 1 \\ x + y &= 2 \\ x + (2 - B)y + 2z &= 3 \end{aligned}$$

For which of the following values of B will row change be required in solving this system using partial pivoting:

$$I : B = -2,\ II : B = \frac{1}{2},\ III : B = 2$$

(a) I and II (correct)
(b) I only
(c) II only
(d) III only
(e) I and III

Average: 57.4074

10. The sum of all eigenvalues of the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$ is

(a) 3 (correct)
(b) 2
(c) 1
(d) 0
(e) -1

Average: 53.7037

11. Let $\{(1,2,1)^t, (1,-1,4)^t\}$ be a set of two linearly independent vectors and by Gram-Schmidt the orthogonal set is $\{(1,2,1)^t, V\}$ then $V =$

(a) $\left(\frac{1}{2}, -2, \frac{7}{2}\right)^t$ (correct)

(b) $\left(\frac{1}{2}, 0, \frac{7}{2}\right)^t$

(c) $(1,1,-2)^t$

(d) $\left(\frac{1}{2}, -1, \frac{7}{2}\right)^t$

(e) $(2,1,0)$

Average:

66.6667

12. If the least squares polynomial of degree one for the following table

x_i	1	2	3	4
y_i	A	3	7	B

is $y = x - 1$, then $3B - 3A =$

(a) 6 (correct)

(b) 7

(c) 5

(d) 4

(e) 3

Average:

59.2593

13. Given the nonlinear system

$$\begin{aligned} 15x_1 + x_2^2 - 4x_3 &= 13 \\ x_1^2 + 10x_2 - x_3 &= 11 \\ x_2^3 - 25x_3 &= -22 \end{aligned}$$

Use the Newton's Method with $X^{(0)} = 0$, then $X^{(1)} \approx$

(a) $(1.1013, 1.1880, 0.8800)^t$ _____ (correct)

(b) $(2.2013, 1.1990, 1)^t$

(c) $(2.1013, 1.8920, 2)^t$

(d) $(1.5201, 1.3288, 1.1111)^t$

(e) $(2.3013, 0.1280, 0.8980)^t$

Average:

68.5185

14. Given the following data

x_i	1	1.5	3
y_i	1.5	2.5	3

Construct the Least square approximation of the form $P(x) = be^{ax}$, then $P(2) \approx$

(a) 2.3532 _____ (correct)

(b) 1.3532

(c) 3.532

(d) 3.4569

(e) 2.1541

Average:

72.2222

15. Given $A = \begin{bmatrix} 2 & 1 \\ -1 & 1 \\ 1 & 1 \\ 2 & -1 \end{bmatrix}$. If $A = USV^t$ is the singular value decomposition, then $S =$

(a) $\begin{bmatrix} \sqrt{10} & 0 \\ 0 & 2 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$ (correct)

(b) $\begin{bmatrix} 2 & 0 \\ \sqrt{10} & 0 \\ 0 & 0 \end{bmatrix}$

(c) $\begin{bmatrix} \sqrt{10} & 0 \\ 0 & 2 \end{bmatrix}$

(d) $\begin{bmatrix} 2 & 0 \\ 0 & \sqrt{10} \end{bmatrix}$

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

Average:

64.8148

16. Given the nonlinear system

$$x_1 - x_1^2 + 4x_2 = 12$$
$$(x_1 - 2)^2 + (2x_2 - 3)^2 = 25$$

Use the Newton's Method with $X^{(0)} = 0$, then $X^{(1)} \approx$

(a) $(-48, 15)^t$ (correct)

(b) $(-48, 10)^t$

(c) $(45, 12)^t$

(d) $(-40, 10)^t$

(e) $(-30, 15)^t$

Average:

55.5556

17. Given the nonlinear system

$$4x_1^2 - 20x_1 + \tfrac{1}{4}x_2^2 + 8 = 0$$
$$\frac{1}{2}x_1x_2^2 - 2x_1 - 5x_2 + 8 = 0$$

Use the method of Steepest Descent with $X^{(0)} = 0$ and $\alpha = 0.1$, then $X^{(1)} \approx$

(a) 0 $(-35.2, -8)^t$ (correct)

(b) 0

(c) 0

(d) 0

(e) 0

Average:

62.963

18. Given the Boundary-Value Problem

$$y'' = y - 3x,\ 1 \le x \le 2,\ y(1) = 1,\ y(2) = 2$$

Use the linear finite difference method with $h = \frac{1}{4}$ to the linear system equation $AW = b$. The **sum** of the third Column of A is equal to:

(a) $\frac{17}{16}$ (correct)

(b) 4

(c) 1

(d) 2

(e) $\frac{15}{16}$

Average:

70.3704

19. Which of the following matrices are orthogonal matrices

$$A = \begin{bmatrix} 2 & -1 \\ 2 & 1 \end{bmatrix}, B = \begin{bmatrix} 1 & \frac{1}{\sqrt{2}} \\ 0 & \frac{1}{\sqrt{2}} \end{bmatrix}, C = \begin{bmatrix} \frac{1}{\sqrt{2}} & -1 \\ 1 & \frac{1}{\sqrt{2}} \end{bmatrix}$$

(a) A and C (correct)
(b) A only
(c) B only
(d) C only
(e) A and B

Average:

61.1111

20. Use the composite Simpson's rule with $n = 4$ to approximate $\int_1^2 x^2 e^{2x}\, dx$

(a) 66.4976 (correct)
(b) 65.4976
(c) 66.0197
(d) 66.8913
(e) 64.4976

Average:

68.5185

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Answer KEY

Q	MASTER	CODE01	CODE02	CODE03	CODE04
1	A	C 15	E 5	E 18	B 6
2	A	E 2	C 20	B 10	D 4
3	A	B 6	E 1	D 17	D 15
4	A	E 11	B 10	B 6	E 19
5	A	C 18	C 6	A 3	B 16
6	A	E 9	D 14	E 4	A 17
7	A	E 5	D 15	D 2	D 2
8	A	B 4	A 19	E 19	A 10
9	A	D 3	B 16	A 8	A 13
10	A	D 17	C 3	E 9	B 5
11	A	C 8	C 13	B 12	D 3
12	A	B 12	D 18	A 13	A 18
13	A	A 10	C 17	D 11	C 20
14	A	C 20	E 9	A 14	E 12
15	A	E 14	C 11	A 5	D 8
16	A	B 1	D 8	E 16	B 1
17	A	D 19	D 4	E 7	A 9
18	A	B 16	B 12	D 15	E 14
19	A	A 7	B 7	B 1	E 7
20	A	D 13	C 2	A 20	A 11

Answer Counts

V	A	B	C	D	E
1	2	5	4	4	5
2	1	4	7	5	3
3	6	4	0	4	6
4	6	4	1	5	4