King Fahd University of Petroleum and Minerals

Department of Mathematics - College of Computing and Mathematics

Math 371 - Numerical computing

Exam I, First Semester (241), 2024-2025

Net Time Allowed: 90 minutes

Name :
ID : **Section :**

Question 1: The fifth approximate solution of $\exp(-x) = 3\log(x)$ using the bisection method in the interval $[0.5, 1.5]$ is

(a) 1.9038

(b) 1.0625

(c) 1.0938

(d) 1.1250

Question 2: Secant method is slower than Newton method

(a) False

(b) True

Secant method's iteration requires

(a) one point-value

(b) two point-values

(c) three point-values

Question 3:

x	0.25	0.5	0.75
$f(x)$	1.65	2.72	4.49

The approximate value of $f(0.43)$ using the second order Lagrange interpolating polynomial is

(a) 2.5147

(b) 2.3014

(c) 2.3498

(d) 3.0241

Question 4: Using four-digit rounding arithmetic $\frac{\sqrt{13}+\sqrt{11}}{\sqrt{13}-\sqrt{11}}$

(a) 23.95

(b) 23.96

(c) 23.90

(d) 24.01

Question 5:

x	1.8	2.0	2.2	2.4	2.6
$f(x)$	3.1204	m	6.0424	8.03014	10.46675

If the composite Simpson's rue gives $\int_{1.8}^{2.6} f(x)dx = 5.03420$, then m is

(a) 4.44217

(b) 3.44559

(c) 4.34331

(d) 10.8479

Question 6: Using the three-point midpoint formula for $f(x) = xcos(x) - x^2sin(x)$, $h = 0.5$, the absolute error on approximating $f'(2)$ is

(a) 0.4235

(b) 0.1001

(c) 0.0423

(d) 0.6023

Question 7: Let $f(x) = 3x^2 - exp(x)$ and given that $f''(x)$ has the maximum value on $[0, 2]$ at $x = \ln(6)$, the larger h to have the error, of approximating $f'(x_0)$ by forward difference formula, within 10^{-2} is

(a) ≤ 0.1812

(b) ≤ 0.0043

(c) ≤ 0.0017

(d) ≤ 0.5741

Question 8: The natural cubic spline of the data $(1, 1)$, $(2, 5)$, and $(3, 4)$ is

$$S(x) = \begin{cases} -\alpha x^3 + 3.75x^2 + 1.50x - 3.00 & \text{if } 1 \leq x \leq 2 \\ \alpha x^3 - 11.25x^2 + 31.50x - 23.00 & \text{if } 2 \leq x \leq 3 \end{cases}$$

The value of α is

(a) 2.50

(b) 7.01

(c) 1.25

(d) -10.04

Question 9: If P_2 is the second Taylor polynomial for $f(x) = 2x\cos(2x) - (x-2)^2$ about $x_0 = 0$, then the bound for the error $|f(0.3) - P_2(0.3)|$ is

(a) 0.1948

(b) 0.0951

(c) 0.2074

(d) 1.0178

Question 10: The composite Trapezoidal rule applied to $\int_1^3 \frac{dx}{7-2x}$ with $h = 0.5$ gives

(a) 0.2591

(b) 3.2013

(c) 0.8417

(d) 1.0384

Question 11: The stepsize h such that the absolute value of the error is within 5.10^{-4} when the composite Trapezoidal rule is used to approximate the integral $\int_2^7 \frac{dx}{x}$ is less than

(a) 0.1445

(b) 0.2591

(c) 0.0133

(d) 0.0693

Question 12: Let $f(x) = 3x^2 - exp(x)$ on the interval $[0, 1]$. By taking $g(x) = \sqrt{exp(x)/3}$ and $p_0 = 0.5$ the minimum number of iterations necessary to obtain an approximation accurate to within 10^{-4} by fixed-point iteration, is

(a) 16

(b) 15

(c) 12

(d) 11

Question 13: Using four-digit rounding arithmetic $\frac{7\pi-22}{e-3.2}$ is

(a) 0.02075

(b) 0.0207

(c) 0.02074

(d) 0.02080

Question 14: The equation $4x^2 - exp(x) - \exp(-x) = 0$ has two positive solutions. Which of the following initial guess, Newton method will not work ?

(a) $p_0 = 1$

(b) $p_0 = 2$

(c) $p_0 = 0$

(d) $p_0 = 3$