CROSS RIVER UNIVERSITY OF TECHNOLOGY, CALABAR
DEPARTMENT OF COMPUTER SCIENCE
FIRST SEMESTER EXAMINATIONS 2018/2019 SESSION

COURSE CODE: CSC 3103
COURSE TITLE: NUMERICAL METHODS **TIME: 2HRS**
INSTRUCTION: Answer any 4 questions

1a. If 0.66266667 is the approximation to the fraction $^2/_3$, compute the absolute error, relative error and percentage error

b. Distinguish between: (i) truncation and rounding (ii) computational and propagated errors, and (iii) sensitive and insensitive problems

2a. Find the next iterative value of the root of the equation $\times^2 - 4 = 0$ using:
(i) Newton-Raphson method, if the initial guess is 3,
(ii) Secant method, if the initial guesses are 3 and 4

b. Write a program that uses either *Secant* **OR** *Newton's* method to find the root of the equation in (a) above

3a. Determine the value of f (-2.5) from the set of function values in the table below using finite difference interpolation scheme.

X	-3	-2	-1	0	1	2	3
F(X)	-27	-8	-1	0	1	8	27

b. Find the best straight line fit to the following data points: (0, 1), (1, 2), (3, 3)

4a. Estimate: $\int_{-0.6}^{0.6} xe^x dx$ using the subdivisions -0.6, -0.4, -0.2, 0.0, 0.2, 0.4, 0.6 by:
(i) Trapezoidal Rule (ii) Simpson's Rule

b. Write a program to evaluate the integral in 4a above using any of the methods mentioned

5a. Write the matrix A below in the form [L] [U], where L is a unit lower triangular matrix and U is an upper triangular matrix:

Matrix A for 5a. ***System of equations for 5b*** ***System of equations for 6a***

$$A = \begin{pmatrix} 25 & 5 & 4 \\ 10 & 8 & 16 \\ 8 & 12 & 22 \end{pmatrix}$$

$$10x_1 + x_2 + 2x_3 = \mathbf{44}$$
$$2x_1 + 10x_2 + x_3 = \mathbf{51}$$
$$x_1 + 2x_2 + 10x_3 = \mathbf{61}$$

$$2x_1 - x_2 = \mathbf{2}$$
$$2x_1 - 3x_2 + x_3 = \mathbf{-2}$$
$$-x_1 + x_2 - 3x_3 = \mathbf{-6}$$

b. Write a program to solve the system of equations shown above using any method.

6a. Solve the system of equations above using:
(i) 3 iterations of the Jacobi method, and (ii) 3 iterations of the Gauss-Seidel method

b. What are the main differences between Jacobi iteration and Gauss-Seidel method?

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COURSE TITLE: NUMERICAL METHODS **TIME: 2HRS**
INSTRUCTION: Answer any 4 questions. Program may be written in any language of choice.

1a. Suppose 0.6624367 is the approximation to the fraction $^2/_3$, give the absolute error, relative error and percentage error.
b. Distinguish clearly between: Round-off and Truncation errors.
c. Name 5 causes of inexact measurements in numerical computation.

2a. Write a program to solve the equation $20 \times^3 - 22 \times^2 - 5 \times -1 = 0$ to 4 decimal places given that it has a root at approximately x=0.6 using direct iteration technique.
b. What is the condition for convergence of an iteration process for the numerical solution of non-linear equations?

3a. Use the Newton's method to find the first 3 approximations to the positive root of $f(x) = x^2 + 3x - 4$ given that $x_0 = 2$.
b. State the Secant's formula for solving f(x)
c. Use a computer program to solve 3(a) above.

4a. What are the uses of interpolation in real life?
b. Determine the value of f(2.5) from the set of function values using the Gregory-Newton forward difference formula.

X	1	2	3	4	5	6
f(x)	0	19	70	171	340	595

c. Write a program to compute the solution of the problem stated in 4(b) above.

5a. Find the best straight line fit to the data points: (0, 1), (1, 2), (3, 3).
b. Write the matrix A below in the form LU, where L is a unit lower triangular matrix and U is an upper triangular matrix:

$$A = \begin{pmatrix} 4 & -1 & -1 \\ -1 & 4 & -1 \\ -1 & -1 & 4 \end{pmatrix}$$

6a. Evaluate the integral $\int_0^2 \frac{dx}{1+x^4}$ to 3 decimal places using Simpson's Rule with five intervals.
b. Develop an algorithm to evaluate the integral in 6(a) above.