UNIVERSITY OF AGRICULTURE, ABEOKUTA
COLLEGE OF NATURAL SCIENCES
DEPARTMENT OF COMPUTER SCIENCE

2009/2010 FIRST SEMESTER EXAMINATIONS

COURSE TITLE:	NUMERICAL ANALYSIS II
COURSE CODE:	CSC 351
UNIT/STATUS:	3 UNITS / COMPULSORY
TIME ALLOWED:	2 $^1/_2$ HOURS
INSTRUCTION:	Attempt Any Four Questions In All.

Question One

a. State the general formula for Lagrange's interpolating polynomial and use the Lagrange's interpolating polynomial to compute the value of the derivative of $y = f(x)$ at $x = 0.4$ from the following table

x	0.0	0.2	0.4	0.6	0.8
$f(x)$	0.12	0.46	0.74	0.90	1.20

b. Using 3-point Gauss-Legendre quadrature, evaluate the integral $\int_{-1}^{1} \frac{x \sin x}{1+x^2} dx$

Question Two

Prepare the table of forward difference for the data in the table below

x	0.2	0.3	0.4	0.5
$f(x)$	0.848	0.817	0.824	0.875

and hence using i) Newton's forward interpolating formula
ii). Stirling's interpolating formula
compute the value of the derivative of $y = f(x)$ at $x = 0.35$.

Question Three

a. Using Simpson's rule, compute the integral $\int_a^b f(x)dx$, where the table for the values of $y = f(x)$ is given below. Also find an error estimate for the computed value.

x	1	2	3	4	5	6	7	8	9	10
y	0.09531	0.18232	0.26236	0.33647	0.40546	0.47000	0.53063	0.58779	0.64185	0.6931

b. Using Trapezoidal's rule, compute the integral $\int_{0.0}^{1.5} f(x)dx$, where the table for the values of $y = f(x)$ is given below

X	0.0	0.5	0.7	0.9	1.1	1.2	1.3	1.4	1.5
Y	0.00	0.39	0.77	1.27	1.90	2.26	2.65	3.07	3.53

Question Four

a. Define the term "Solution of differential equation".

b. Use Euler's algorithm to find an approximate value of $y(1)$, where y is the solution of the IVP $y' = -(y^2)$, $y(0) = 1$, $0 \le x \le 0.5$ with step size 0.1. Show that the exact solution is $y(x) = \frac{1}{x+1}$. Calculate the error at each step and tabulate the results.

c. Use Runge-Kutta to solve $y' = \sqrt{x^2 + y}$ *for* $0.0 \le x \le 1.0$, where $h = 0.2$

Question Five

a. Explain these terms "Over-determined" and "Under-determined systems".

b. Use i.) Gauss-Jacobi method
ii.) Gauss-Jordan method
to solve the system of linear equations below

$$x + 7y - z = 3$$
$$5x + y + z = 9$$
$$-3x + 2y + 7z = 17$$

obtaining x, y and z correct to the nearest integer.

Question Six

a. Using the following data and least square approximations, find the best fit straight line and the best fit parabola. Your solutions should be accurate to four decimal places.

x	-3	-1	0	1	2
y	0	3	6	8	9

Should this data be modeled by a straight line or by a parabola? Why?

b. Find the matrix X and the vector y that would be used in the normal equations to find the best fit cubic (third degree) polynomial to the following data:

x	-2	-1	0	1	3
y	44	11	3	1	-91