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DB-003-001618

Seat No. ________

B. Sc. (Sem. VI) (C.B.C.S.) Examination

April / May – 2015

Mathematics : Paper - BSMT-603(A)

(Optimization & Num. Analysis - II)

Faculty Code : 003
Subject Code : 001618

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

Instructions : (i) All the questions are compulsory.
(ii) Write answers of MCQs in your answer book.

1 Answer the following : **20**

(1) Optimum values of the objective functions of primal and dual LPP problems are

(A) Always equal (B) Never equal
(C) Sometimes equal (D) None of these

(2) The NWCM (North West Corner Method) to solve a transportation problem is one of the methods for finding

(A) Optimum solution
(B) Degenerate solution
(C) An initial basic feasible solution
(D) None of these

(3) The Hungarian method for solving an Assignment Problem was given by

(A) Charles Babbage (B) Bob Simplex
(C) Optimal Rose (D) None of these

(4) A function f(x) on $\phi \neq S \subset R^n$ is said to be concave if

(A) –f(x) is also concave (B) f(x) is also convex
(C) –f(x) is convex (D) None of these

(5) A linear function $Z = 3x, x \in R^n$ is always

(A) Concave

(B) Convex

(C) Convex or Concave always

(D) None of these

(6) The method of penalties is also known as

(A) Big-M method

(B) Two phase method

(C) Biggest method to solve LPP

(D) None of these

(7) A basic solution of the system is called degenerate if

(A) One or more of basic variables vanish

(B) None of basic variables vanishes

(C) All the basic variables vanish

(D) None of these

(8) A solution of a general LPP is said to be a feasible solution if

(A) It satisfies inequalities

(B) It satisfies the non-negative restrictions too

(C) It satisfies only equalities

(D) None of these

(9) The original LPP from which the dual LPP is obtained is known as

(A) Main LPP | (B) Auxiliary LPP

(C) Primal LPP | (D) None of these

(10) The dual of the dual of an LPP is

(A) Dual | (B) Primal

(C) Second order dual | (D) None of these

(11) In numerical differentiation, we make use of Gregory-Newton's backward interpolation formula if

(A) Values of x are equispaced

(B) Values of x are not equispaced

(C) the derivative is required near the end of the table

(D) in case of (A) and (C)

(12) Laplace-Everett's interpolation formula is a ____ formula.

(A) Forward Interpolation (B) Backward Interpolation

(C) Central Interpolation (D) None of these

(13) The process of finding the value of the argument corresponding to a given value of the function, one can apply

(A) Gauss Forward Interpolation

(B) Gauss Backward Interpolation

(C) Lagrange's Method

(D) None of these

(14) Bessel's formula is better suited if

(A) $p > \frac{1}{2}$ (B) $p > \frac{1}{5}$

(C) $\frac{-1}{4} < p < \frac{1}{4}$ (D) None of these

(15) Numerical differentiation should be performed if it is clear from the tabulated values that

(A) differences of some order are constant

(B) differences of any order are not constant

(C) either in case of (A) or (B)

(D) None of these

(16) Numerical integration of a function f is known as quadrature if

(A) f is either univariate or multivariate function

(B) f is a multivariate function

(C) f is a univariate function

(D) None of these

(17) To derive Simpson's $\frac{1}{3}$ rule from trapezoidal rule, we put n = ____.

(A) 0 (B) 3

(C) 2 (D) None of these

(18) When a problem is formulated into an ordinary differential equations satisfying certain given conditions which are prescribed for two or more points, then the differential equation together with these conditions is known as

(A) Initial value problem

(B) Boundary value problem

(C) Both (A) and (B)

(D) None of these

(19) To apply Milne's method, we must have at least how many values prior to the required value ?

(A) Two (B) Three

(C) Four (D) None of these

(20) To apply Simpson's $\frac{3}{8}$ rule to a third degree polynomial f(x), the number of intervals n must be multiple of

(A) 2 (B) 3

(C) 8 (D) None of these

2 (a) Answer any three : **6**

(i) Define : Objective function

(ii) Define : Concave function

(iii) Define : Basic feasible solution

(iv) Define : Unbalanced transportation problem

(v) Write matrix form of an assignment problem

(vi) What is Simplex algorithm ?

(b) Answer any three : **9**

(i) Write canonical form of an LPP.

(ii) Write mathematical form of a general transportation problem.

(iii) Explain : Least cost method.

(iv) Explain mathematical form of an assignment problem.

(v) Write the associated dual problem of the following LPP :

Maximize $Z = 4x_1 + 2x_2$

Subject to $x_1 + x_2 \geq 3$

$x_1 - x_2 \geq 2$

where $x_1, x_2 \geq 0$

(vi) Explain optimality test of a solution of a Transportation Problem.

(c) Answer any two : **10**

(1) Solve the following LPP by using Simplex method :

Maximize $Z = 3x_1 + 2x_2$

Subject to $x_1 + x_2 \leq 4$

$x_1 - x_2 \leq 2$

where $x_1, x_2 \geq 0$

(2) Use two-phase Simplex method to

Maximize $Z = 5x_1 - 4x_2 + 3x_3$

Subject to $2x_1 + x_2 - 6x_3 = 20$

$6x_1 + 5x_2 + 10x_3 \leq 76$

$8x_1 - 3x_2 + 6x_3 \leq 50$

where $x_1, x_2, x_3 \geq 0$

(3) By using Big-M method solve the following LPP optimally :

Maximize $Z = 2x_1 + x_2 + 3x_3$

Subject to $x_1 + x_2 + 2x_3 \leq 5$

$$2x_1 + 3x_2 + 4x_3 = 12$$

where $x_1, x_2, x_3 \geq 0$

(4) Explain Hungarian method to solve an assignment problem.

(5) Solve the following transportation problem optimally :

From	To			Available
	A	B	C	
I	6	8	4	14
II	4	9	8	12
III	1	2	6	05
Demand	06	10	15	

3 (a) Answer any three : **6**

(i) Define : Interpolation.

(ii) State any two properties of divided difference.

(iii) What is the main drawback of Lagrange's interpolation formula ?

(iv) Define : Numerical integration.

(v) Write general quadrature formula.

(vi) Write algorithm of Runge-Kutta method of second order.

(b) Answer any three : **9**

(i) If $f(x) = x^3 - 9x^2 + 17x + 6$, compute $f(-1, 1, 2)$.

(ii) Find $f(x)$ by Lagrange's formula if $f(0) = 648$, $f(2) = 704$, $f(3) = 729$, $f(6) = 792$.

(iii) Use Laplace-Everett's formula to obtain $f(1.15)$ given that $f(1)=1.000$, $f(1.1)=1.049$, $f(1.2)=1.096$, $f(1.3)=1.140$.

(iv) By using Newton's forward difference formula, derive

$$D^3 y_0 = \frac{1}{h^3}\left[\Delta^3 y_0 - \frac{3}{2}\Delta^4 y_0 + \frac{7}{4}\Delta^5 y_0 - .....\right]$$

(v) Derive : Trapezoidal rule.

(vi) Estimate the length of the arc of the curve $3y = x^3$ from $(0,0)$ to $(1,3)$ using Simpson's $\frac{1}{3}$ rule taking eight sub-intervals.

(c) Answer any two : **10**

(i) Derive Gauss forward interpolation formula.

(ii) Derive Bessel's interpolation formula.

(iii) Calculate $f'(90)$ and the maximum value of the function by using Stirling's formula from the following data :

x	60	75	90	105	120
$f(x)$	28.2	38.2	43.2	40.9	37.7

(iv) Evaluate $\int_0^{10} \frac{dx}{1+x^2}$ by using Simpson's $\frac{3}{8}$ rule.

(v) Use Runge-Kutta method of order four to find y at $x = 0.1$ and $x = 0.2$ given that, $x(dy + dx) = y(dx - dy)$; $y(0) = 1$.