P1005

[3935] - 102

M.Sc. Tech.

MATHEMATICS

Industrial Mathematics with Computer Applications

MIM - 102 : Algebra - I

(New Course) (Semester - I) (2008 Pattern)

Time :3 Hours]   *[Max. Marks :80*

Instructions to the candidates:

1)   *All questions are compulsory.*

2)   *Figures to the right indicate maximum marks.*

Q1) Attempt <u>any EIGHT</u> of the following: **[16]**

   a)   If 'a' is a generator of a cyclic group G, show that a^{-1} is also a generator.

   b)   Compute the product (1 4 7) (7 8) (2 5 7) in S_8.

   c)   Is H = {1, –1, i, –i} a normal subgroup of the group of Quaternions? Justify.

   d)   Are the groups Z_6 and S_3 isomorphic? Justify.

   e)   Let $\phi : (R, +) \rightarrow (C^*, \bullet)$ be a homomorphism defined by $\phi(x) = \cos x + 1$ sin$x$. Determine Kerϕ.

   f)   Is $x^3 + 2x + 3$ an irreducible polynomial in $Z_5[x]$? Justify.

   g)   Is every Integral Domain a Field? Justify.

   h)   Find all units in Z[i].

   i)   Is the following statement True or False? Justify.
'The field of quotients of Q is R.'

   j)   Give the characteristics of the following rings: (α) 2Z (β) Z_3 x Z_4.

Q2) a)   Attempt <u>any ONE</u> of the following: **[6]**

     i)   Show that a non-empty subset H of a group G is a subgroup of G iff $ab^{-1} \in H$, $\forall a, b \in H$.

     ii)   Prove that every subgroup of a cyclic group is cyclic.

   b)   Attempt <u>any TWO</u> of the following: **[10]**

     i)   If G is a finite group of prime order, show that G is cyclic.

     ii)   Let G be a group. Show that the relation '~' defined on G by a~d iff 'a is a conjugate of b' is an equivalence relation on G.

     iii)   If G is an abelian group and H is a normal subgroup of G, prove that the quotient group G/H is also abelian. Is the converse true? Justify.

P.T.O.

Q3) a) Attempt <u>any ONE</u> of the following: **[6]**

    i) Let G be a group and $O(G) = P^2$, where P is a prime number. Prove that G is abelian.

    ii) Let ϕ be a homomorphism of a group G onto a group $\overline{G}$ with kernel K. Prove that $\dfrac{G}{K} \simeq \overline{G}$.

  b) Attempt any TWO of the following: **[10]**

    i) Prove that a group of order 42 is not simple.

    ii) Let N and M be two normal subgroups of a group G such that $N \cap M = \{e\}$. Show that nm = mn, for all $n \in N$, $m \in M$.

    iii) Let H be a subgroup of a group G and $a \in G$. Let $aHa^{-1} = \{aha^{-1}/h \in H\}$. Show that aHa^{-1} is a subgroup of G. If H is finite, what is $O(aHa^{-1})$?

Q4) a) Attempt any ONE of the following: **[6]**

    i) Let R be a commutative ring with unity. If M is a maximal ideal of R, prove that $\dfrac{R}{M}$ is a field.

    ii) Prove that the characteristic of an Integral Domain is either O or a prime.

  b) Attempt any TWO of the following: **[10]**

    i) Let R be a commutative ring with unity and I, J be ideals of R, Show that $I + J = \{a+b/a \in I, b \in J\}$ is also an ideal of R.

    ii) Find all prime ideals of Z_{10}.

    iii) Use Euclidean Algorithm in Z[i] to find a gcd of 11+7i and 18-i in Z[i].

Q5) a) Attempt any ONE of the following: **[6]**

    i) Prove that an ideal $A = (a_0)$ is a maximal ideal of a Euclidean ring R iff a_0 is a prime element of R.

    ii) Prove that the product of two primitive polynomials is a primitive polynomial.

  b) Attempt any TWO of the following: **[10]**

    i) Prove that if R is an Integral Domain then R[x] is also an Integral Domain.

    ii) Show that the polynomial $1 + x + x^2 + \text{----} + x^{10}$ is irreducible over Q.

    iii) Prove that $\dfrac{Z_3[x]}{\langle x^3 + 2x + 1 \rangle}$ is a field.

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[3935] - 103

P1006

M.Sc. Tech.

Industrial Mathematics with Computer Applications

MIM - 103 : Discrete Mathematical Structures - I

(New Course) (Sem. - I) (2008 Pattern)

Time :3 Hours] *[Max. Marks :80*

Instructions to the candidates:

    1)   *All questions are compulsory.*

    2)   *Figures to the right indicate full marks.*

Q1) Attempt <u>any eight</u> of the following: **[16]**

    a)   Using the truth table show that $\neg(p \leftrightarrow q)$ and $p \leftrightarrow \neg q$ are logically equivalent.

    b)   Determine whether $(\neg q \wedge (p \rightarrow q)) \rightarrow \neg p$ is a tautology.

    c)   There are 32 microcomputers in a computer center. Each microcomputer has 24 ports. How many different ports to a microcomputer in the center are there?

    d)   How many numbers must be selected from the set $\{1, 2, 3, 4, 5, 6\}$ to guarantee that at least one pair of these numbers add up to 7?

    e)   Use a table to express the values of $F(x, y, z) = x + yz$.

    f)   Construct circuits that produce the output of $(x+y)\overline{x}$.

    g)   Let A = $\{a, b, c\}$ and consider the semigroup $(A^*, \cdot)$ where $\cdot$ is the operation of catenation. If $\alpha = abac$, $\beta = cba$, and $\gamma = babc$, compute

       i) $(\alpha . \beta) . \gamma$ ii) $\gamma . (\alpha . \alpha)$.

    h)   Let X = $\{1, 2, 3\}$. Draw the Harse diagram of $(P(X), \subseteq)$ where $P(X)$ is the power set of X and $\subseteq$ represents the subset relation.

    i)   Is the poset $\{2, 3, 4, 6\}$ under divisibility a lattice? Justify!

    j)   "Every non-empty subset of a chain is a sublattice". Justify!

Q2) a) Attempt <u>any one</u> of the following: **[6]**

    i) Give a direct proof that if *m* and *n* are both perfect squares, then *mn* is also a perfect square.

    ii) Show that the premises "Everyone in this discrete mathematics class has taken a course in computer science" and "Marla is a student in this class" imply the conclusion "Marla has taken a course in computer science".

  b) Attempt <u>any two</u> of the following: **[10]**

    i) Prove that if *n* is an integer and $3n+2$ is odd then *n* is odd.

    ii) Show that $\neg \forall x\,(P(x) \to Q(x))$ and $\exists x\,(P(x) \wedge \neg Q(x))$ are logically equivalent.

    iii) Use rules of inference to show that the hypothesis "Randy works hard", "If Randy works hard, then he is a dull boy", and "If Randy is a dull boy, then he will not get the job" imply the conclusion "Randy will not get the job".

Q3) a) Attempt <u>any one</u> of the following: **[6]**

    i) In any lattice show that for all $a, b, c \in L; a \wedge (b \vee c) \geq (a \wedge b) \vee (a \wedge c)$.

    ii) Prove that two lattices A and B are relatively complemented iff $A \times B$ is relatively complemented.

  b) Attempt <u>any two</u> of the following: **[10]**

    i) the poset X = {2, 3, 4, 6} of non-trivial factors of 12 under divisibility is self dual.

    ii) Prove that homomorphic image of a relatively complemented lattice is relatively complemented.

    iii) Prove that distributive lattice is always modular. Is the converse true?

Q4) a) Attempt <u>any one</u> of the following: **[6]**

    i) Define a Boolean algebra. Show that in a Boolean algebra if $x \wedge y = 1$ then $x = 1$ and $y = 1$.

    ii) Prove that any two Boolean algebras having *n* elements each, are isomorphic.

  b) Attempt <u>any two</u> of the following: **[10]**

    i) Use K-maps to minimize the sum-of-products expansions:

$$x y \bar{z} + x \bar{y} \bar{z} + \bar{x} y z + \bar{x} \bar{y} \bar{z}.$$

ii) Let B be a Boolean algebra. For $x, y, z \in B$, prove that

(α) If $y \wedge x = z \wedge x$ and $y \wedge x' = z \wedge x'$ then $y = z$

(β) $(x \wedge y)' = x' \vee y'$.

iii) Use the Quine -McCluskey method to simplify the following sum-of-products expansion:

$x y z + x \bar{y} z + \bar{x} y z + \bar{x} \bar{y} z + \bar{x} y \bar{z}$

Q5) a) Attempt <u>any one</u> of the following: **[6]**

i) Let $A = \{0, 1\}$ and consider the free semigroup $(A^*, \cdot)$ generated by A. Define the relation on A by $\alpha R \beta$ iff α and β have the same number of 1's.

Show that R is a congruence relation on $(A^*, \cdot)$.

ii) Let T be the set of all even integers. Show that the semigroups $(Z, +)$ and $(T, +)$ are isomorphic.

b) Attempt <u>any two</u> of the following: **[10]**

i) Prove that Z^+, the set of all positive integers together with binary operation *, defined by

$a*b = \min \{a, b\}$ is a semigroup

ii) A survey of households in the United States reveals that 96% have at least one television set, 98% have telephone service, and 95% have telephone service and at least one television set. What percent of households in the United States have neither telephone service nor a television set?

iii) How many functions are there from a set with *m* elements to a set with *n* elements?

[3935] - 104

P1007

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 104 : C Programming

(Sem. - I) (2008 Pattern)

Time :3 Hours]   *[Max. Marks :80*

Instructions to the candidates:

    1)   *All questions are compulsory.*

    2)   *Figures to the right indicate full marks.*

Q1) Attempt any eight of the following: **[16]**

    a)   Explain the conditional operator with the help of the example.

    b)   What is a pre-processor directive?

    c)   Explain the use of break statement.

    d)   State the meaning of the following declaration.

         void ($*$ a[5]) (void $*$);

    e)   Declare a union with one float variable and char away of 10.

    f)   What is the difference between the following two directives

         # include "conio.h" and # include < conio.h >.

    g)   What is the difference between printf( ) & puts ( )

    h)   Compare between bitwise operator & with bitwise operator ^.

    i)   Explain the syntax of malloc ( ) function.

    j)   Define - array.

Q2) Attempt any two of the following: **[16]**

    a)   Write a program to find it a square matrix is symmetric.

    b)   Write a program to sort a set of names stored in an array in alphabetical order.

    c)   Write a program using a function to find the binary equivalent of a given decimal integer & display it.

Q3) Attempt any four of the following: [16]

    a)   Explain different storage classes in C.

    b)   Explain pointer arithmetic in C.

    c)   Compare & contrast between switch and if-else statement.

    d)   Explain the concept of recursion with the help of the example.

    e)   Write a short note on structures in C.

    f)   Explain the concept of precedence and associativity.

Q4) Attempt any eight of the following: [16]

    a)   Point out errors, if any in the following declarations.

        i)   name = 'Ajay';   ii)   int = 10 * 5;

    b)   What is output to the following code.

```
# include (stdio.h)
void main ( )
{
   int a, b;
   a = – 3 -- 3;
   b = –3 -- (–3);
   printf ("a = %d b = %d", a, b);
}
```

    c)   What is the output of the following code.

```
# include (stdio.h)
main ( )
{
   int x = 10, y = 20;
   if (x ==y);
      printf ("%d %d", x, y);
}
```

    d)   What is the output of the program, if program is correct.

```
# include (stdio.h)
main ( )
{
   int j = 10, k = 12;
   if (k >=j)
      {
         k = j;
         j = k;
      }
}
```

e) Explain in short the scope of a variable.

f) What is the use of typedef statement.

g) What is the output of the following code

```
#  include (stdio.h)
void main ( )
{
   int i = 0;
   for (; i ;)
         printf(" \n Hello World");
}
```

h) What is function prototype?

i) If P= 7000 then find the value of P<<2.

j) Distinguish between strcat ( ) and strncat ( ) functions.

Q5) Attempt any four of the following: **[16]**

a) Explain the concept of pass by value and pass by reference with the help of example.

b) Explain the concept of pointer to pointer with the help of example.

c) Explain the use of any four string handling functions.

d) Write a function power (a, b) to calculate the value of a raised to b.

e) Write a function to find the smallest number in an array using pointers.

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[3935] - 201

P1009

M.Sc. Tech. (Sem. - II)
MATHEMATICS
Industrial Mathematics with Computer Applications
MIM - 201 : Real and Complex Analysis
(New Course) (2008 Pattern)

Time :3 Hours]   *[Max. Marks :80*

Instructions to the candidates:
> *1)*   *All questions are compulsory.*
> *2)*   *Figures to the right indicate full marks.*

Q1) Attempt <u>any eight</u> of the following: **[16]**

   a)   If $M^*E = 0$ then prove that E is measurable.

   b)   Show that for any measurable function f, ess.sup $f \leq$ sup f.

   c)   Let f and g be two nonnegative measurable functions. If f is integrable over E and $g(x) < f(x)$ on E, then prove that g is also integrable on E.

   d)   Prove that continuous functions are measurable.

   e)   Give an example where strict inequality occures in Fatou's Lemma.

   f)   Let $f : D \to C$ be a continuous function and let D be a connected set. Prove that $f(D)$ is a connected set.

   g)   Show that $Re(z)$ is nowhere differentiable in C.

   h)   State the Root test.

   i)   Evaluate $\int\limits_{|z-a|=1} \dfrac{e^{2\pi \partial}}{z-a} dz$

   j)   Derive polar form of the CR equations

Q2) a)   Answer <u>any one</u> of the following: **[6]**

     i)   Let A be any set, and E_1, E_2, --, E_n a finite sequence of disjoint measurable sets. Prove that

$$m^*\left(A \cap \left(\bigcup_{i=1}^{n} E_i \right) \right) = \sum_{i=1}^{n} m^*(A \cap E_i)$$

ii) Let ϕ and Ψ be simple functions which vanishes outside a set of finite measure with $\Psi \leq \phi$ a.e. then prove that $\int \Psi \leq \int \phi$.

b) Answer <u>any two</u> of the following: **[10]**

    i) Let f be a measurable function and $f = g$ a.e. prove that g is measurable.

    ii) State and prove the Bounded convergence theorem.

    iii) If f and g are non-negative measurable functions then prove that

$$\int_E f + g = \int_E f + \int_E g .$$

Q3) a) Answer <u>any one</u> of the following: **[6]**

    i) Let g be integrable over E and let $\{fn\}$ be a sequence of measurable functions such that $|fn| \leq g$ on E and for almost all x in E, we have

$$f(x) = \underset{n \to \infty}{Lim} \ fn \ (x) \text{ prove that } \int_E f = \underset{n \to \infty}{Lim} \int_E fn$$

    ii) Let f be a bounded function defined on $[a, b]$. If f is Riemann integrable on $[a, b]$ then prove that it is measurable and

$$R\int_a^b f(x)dx = \int_a^b f(x) dx$$

b) Answer <u>any two</u> of the following: **[10]**

    i) Discuss the convergence of $\sum_{k=1}^{\infty} \dfrac{z^{k-1}}{(1-z^k)(1-z^{k+1})}, (|z| \neq 1)$.

    ii) Suppose that f is analytic in a domain D. Prove that if $f'(z) \equiv 0$ in D then f is constant.

    iii) Let f has simple pole at $z = z_0$ and let h be analytic at z_0 with $h(z_0) \neq 0$. Prove that Res $(f(z)h(z); z_0) = h(z_0)$ Res $(f(z); z_0)$.

Q4) a) Answer <u>any one</u> of the following: **[6]**

    i) Let $f(z)$ has an isolated singularity at z_0, prove that $z = z_0$ is a removable singularity iff one of the following conditions hold:

       1) $\underset{z \to z_0}{Lim} \ f(z)$ exists .

       2) $\underset{z \to z_0}{Lim} (z - z_0) f(z) = 0.$

    ii) Suppose that f is analytic in a domain D and a is a point in D such that $|f(z)| \leq |f(a)|$ holds for all $z \in$ D. Prove that f is constant.

b) Answer <u>any two</u> of the following: **[10]**

i) Find Laurent series expansion of $f(z) = \log\left(z^n / z^{n-1}\right)$ for $|z| > 1$, where n is a fixed positive integer.

ii) Prove that every zero of a nonzero analytic function f is isolated.

iii) Let f be analytic in a simply connected domain D & γ be a closed contour in D and $a \in D - \{\gamma\}$ Prove that $f(a)\, \eta(\gamma; a) = \dfrac{1}{2\pi i} \int_{\gamma} \dfrac{f(z)}{z - a} dz$, where $\eta(\gamma; a)$ is called winding number of curve γ.

Q5) a) Answer <u>any one</u> of the following: **[6]**

i) Prove that for any analytic function f in a simply connected domain D there is a function F in D such that $F'(z) = f(z)$ and F is unique upto an additive constant.

ii) Prove that every automorphism f from unit disk $\{z \in C \,|\, |z| < 1\}$ into itself with $f(0) = 0$ is given by $f(z) = z e^{i\theta}$.

b) Attempt <u>any two</u> of the following: **[10]**

i) Let f be analytic in a domain D and suppose that at some point $a \in D$, $f^{(n)}(a) = 0$ for all $n = 0, 1, 2, \text{-----}$ prove that $f(z) \equiv 0$ on D.

ii) Prove that for every closed contour γ in C and $a \in C - \{\gamma\}$, $\eta(\gamma; a)$ is an integer.

iii) Prove that the series $\sum\limits_{n=0}^{\infty} a_n z^n$ and the k - times derived series defined by $\sum\limits_{n \geq k} n(n-1) \text{ -- } (n-k+1)\, a_n\, z^{n-k}$ have the same radius of convergence.

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P1010

[3935] - 202

M.Sc. Tech. (Sem. - II)
MATHEMATICS
Industrial Mathematics with Computer Applications
MIM - 202 : Algebra - II
(New) (2008 Pattern)

Time :3 Hours]   *[Max. Marks :80*

Instructions to the candidates:

    1)   *All questions are compulsory.*

    2)   *Figures to the right indicate full marks.*

Q1) Attempt <u>any eight</u> of the following: **[16]**

    a)   Show by an example that the union of two subspaces of a vector space need not be a subspace.

    b)   Let F be a field and let V be the vector space of all n x n matrices over F. Is W a subspace of V? Where

         W = Set of all n x n matrices which are invertible.

    c)   Find co-ordinates of $(1, 2, 3)$ relative to the basis $B = \{(1, 2, -3), (1, -3, 2), (2, -1, 3)\}$.

    d)   Show that the set $S = \{1, 1+x, 1+x^2\}$ is a basis for $P_2(x)$, the vector space of polynomials of degree ≤ 2.

    e)   Which of the following functions $T: R^2 \rightarrow R^2$ are linear transformations? Justify your answer.

         i) $T(x, y) = (x + y + 1, x - y)$

         ii) $T(x, y) = (\cos x, y)$

    f)   Under what condition the vectors u and v satisfy, $\|u+v\|^2 = \|u\|^2 + \|v\|^2$.

    g)   Construct a field with 9 elements.

    h)   'Every algebraic extension is a finite extension'. Is this statement true? Justify your answer.

    i)   If E is an extension of a field F of degree 12, and $F \subseteq E'$ is a subfield of E. Is it possible that $[E' ;F] = 7$? Justify your answer.

    j)   Find Galois group of $x^2 - 2$ over field of rationals Q.

P.T.O.

Q2) a) Attempt any <u>ONE</u> of the following: [6]

    i) Let U, V be vector spaces over a field F. and let T: U $\to$ V be a linear transformation from U into V and let U be a finite dimensional vector space. Prove that,
dim (U) = rank (T) + Nullity (T).

    ii) Let V be a vector space and B = $\{v_1, v_2$ --- $v_n\}$ be a basis for a vector space V. Then prove that any set with more than n-vectors is linearly dependent set.

  b) Attempt any <u>TWO</u> of the following: [10]

    i) Determine whether the set
S = $\{1 + x + x^2, x + x^2, x - x^2\}$ is a basis for V = $P_2(X)$ = A vector space of all polynomials with degree ≤ 2.

    ii) Find a basis and dimension for the row space of

$$A = \begin{bmatrix} 1 & -2 & 0 & 0 & 3 \\ 2 & -5 & -3 & -2 & 6 \\ 0 & 5 & 15 & 10 & 0 \\ 2 & 6 & 18 & 8 & 6 \end{bmatrix}.$$

    iii) Let T be a linear operator on R^3 which is represented in the standard ordered basis by the matrix.

$$A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 1 \\ 0 & 0 & 3 \end{bmatrix}$$

    Determine whether T is diagonalizable.

Q3) a) Attempt any <u>ONE</u> of the following: [6]

    i) Let S = $\{\alpha_1, \alpha_2 \,.... \,\alpha_n\}$ be a set of non-zero vectors in an inner product space V. If every pair of distinct vectors in S are orthogonal then prove that S is linearly independent.

    ii) Let L and N be submodules of a module M. Prove that L$\cap$N and L+N are submodules of M. What about L$\cup$N? Justify your answer.

  b) Attempt any <u>TWO</u> of the following: [10]

    i) Let T : $R^3 \to R^3$ be a Linear transformation defined by
T(x,y,z) = $(x + 2y + 3z, 2x + 3y + 4z, 2x + 4y + 5z)$
Find basis and dimensions of ker (T) and range of T.

ii) Apply Gram-Schmidt process to the vectors, $v_1 = (1, 1, 1)$, $v_2 = (-1, 1, 0)$ $v_3 = (1, 2, 1)$ to obtain an orthonormal basis for R^3 with the standard inner product on R^3.

iii) Let M be an R-module. Define:

$N = \{a \in R | a.M = 0\}$ Prove that N is a left ideal of R. Find N for the Z-module $M = Z_n$.

Q4) a) Attempt any <u>ONE</u> of the following: **[6]**

i) If E is finite extension of a field F of degree m and K is finite extension of E of degree n, then prove that

$[K : F] = m.n$

ii) Let F be a field and let $f(x)$ be a non-constant polynomial in $F[x]$. Prove that there exists an extension field E of F and $\alpha \in E$ such that $f(\alpha) = 0$.

b) Attempt any <u>TWO</u> of the following: **[10]**

i) Find the degree of the extension field $Q(\sqrt{3}, \sqrt{5})$ over the field of rationals Q and over the field $Q(\sqrt{3})$. Also show that

$Q(\sqrt{3}, \sqrt{5}) = Q(\sqrt{3} + \sqrt{5})$

ii) Are the numbers α and β algebraic over the field of rationals Q?

where $\alpha = \sqrt{3\sqrt{3} + 5}$ and $\beta = \sqrt{\sqrt{\sqrt{2} + \sqrt{3}}}$.

iii) Find splitting field of the polynomial $x^3 - 2$ over the field of rational numbers Q.

Q5) a) Attempt any <u>ONE</u> of the following: **[6]**

i) If E is a finite field of characteristic P then prove that E contains exactly P^n elements for some positive integer n.

ii) For any prime p,

Let $f(x) = x^{p-1} + x^{p-2} + ... + x + 1$. Prove that $f(x)$ is irreducible over Q; and find its splitting field. Is it a Galois extension of Q?

b) Attempt any <u>TWO</u> of the following: **[10]**

i) Find primitive 5th roots and square roots of the unity in Z_{11}.

ii) Find the splitting field of $f(x) = x^4 + 1$ over Q.

iii) Is normality transitive? justify your answer.

P1011

[3935] - 203

M.Sc. Tech.

MATHEMATICS

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 203 : Discrete Mathematical Structures - II

(2008 Pattern) (New) (Sem. - II)

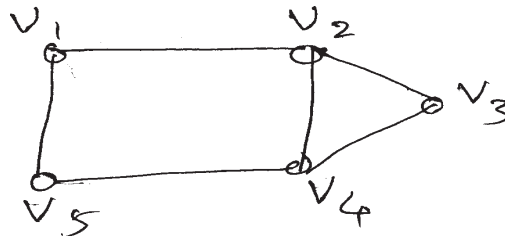*Time :3 Hours]*   *[Max. Marks :80*

Instructions to the candidates:

    1)   *All questions are compulsory.*

    2)   *Figures to the right indicate full marks.*

Q1) Attempt <u>any eight</u> of the following: **[8 × 2 = 16]**

    a)   Explain the term 'cutvertex'.

    b)   Find complement of following graph G.

    c)   Show that there are 4 non isomorphic simple graphs on 3 vertices.

    d)   Define : Complete asymmetric digraph.

    e)   Find the edge connectivity for the complete graph K_5.

    f)   How many edges must a planar graph have if it has 7 regions and 5 vertices.

    g)   Define: Eccentricity of a vertex in graph G.

    h)   Fuse two vertices V_2 and V_7 in the graph G.
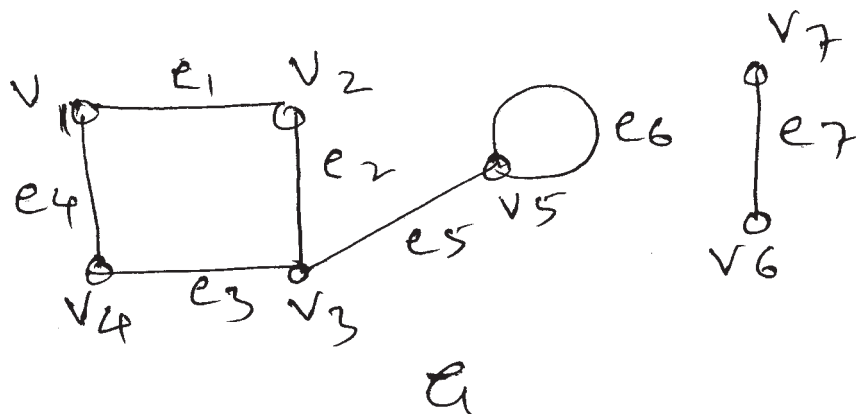
i) Justify: The chromatic number of any cycle is 2.
j) Explain : 'Chinese postman problem'.

Q2) a) Attempt <u>any one</u> of the following: **[1 × 6 = 6]**
   i) Prove that edge 'e' of a connected graph G is not an isthmus if and only if 'e' is in some circuit of G.
   ii) State and prove Euler's theorem for a planar graph G.
   b) Attempt <u>any two</u> of the following: **[2 × 5 = 10]**
   i) Determine whether following graphs are isomorphic or not.
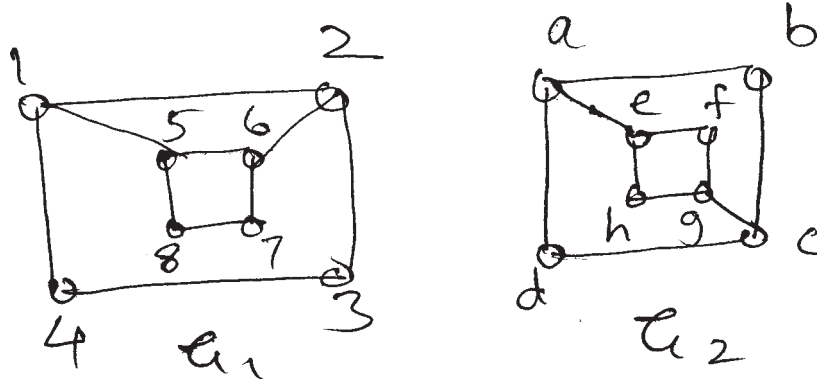
   ii) 1) Find union of two null graphs N_3 and N_4.
       2) Intersection of two complete graphs K_3 and K_4.
       3) Draw graphs G-V and G-e where G is
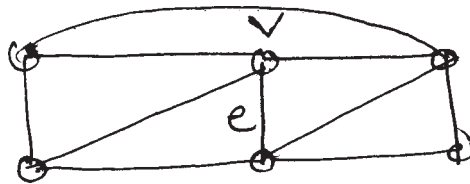
   iii) Find the fundamental cut-sets of the following graph G with respect to the given spanning tree T.
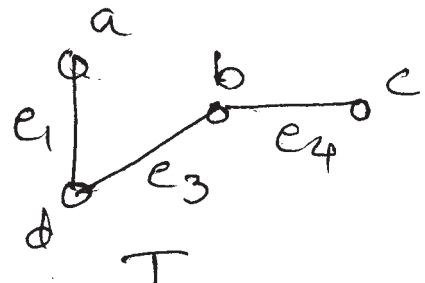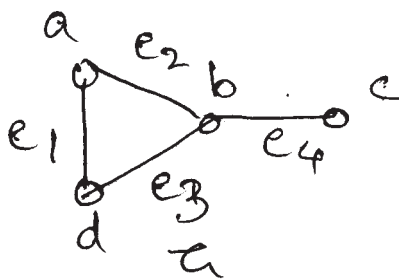
Q3) a) Attempt <u>any one</u> of the following: [**1 × 6 = 6**]

     i)   Prove that every tree has either one or two centres.

     ii)   Prove that a connected graph G is an Euler graph if and only if it can be decomposed into circuits.

   b) Attempt <u>any two</u> of the following: [**2 × 5 =10**]

     i)   Find the conditions for $K_{m,n}$ the complete bipartite graph to have an Eulerian line.

     ii)   Find shortest spanning tree for the following weighted graph using Kruskal's algorithm
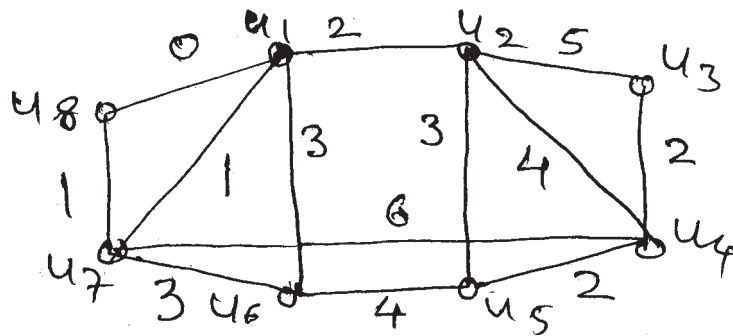
     iii)   Determine the number of regions defined by a connected planar graph with 6 nodes and 10 edges. Draw a simple and a non simple graph.

Q4) a) Attempt <u>any one</u> of the following: [**1 × 6 = 6**]

     i)   Explain depth first search (DFS) algorithm for a graph.

     ii)   Explain largest - First sequential algorithm for colouring a graph G.

   b) Attempt <u>any two</u> of the following: [**2 × 5 = 10**]

     i)   Find the maximum flow using Ford Fulkerson algorithm.
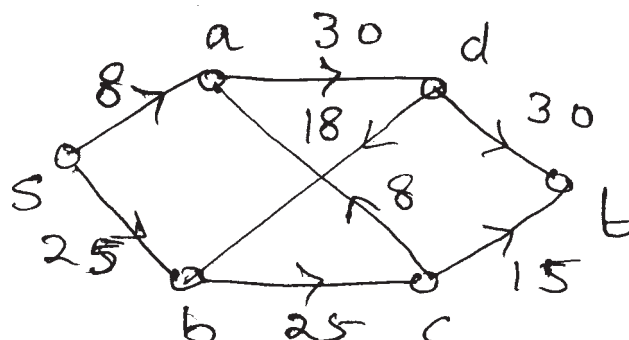
ii) Find adjacency matrix and incidence matrix of the following graph.
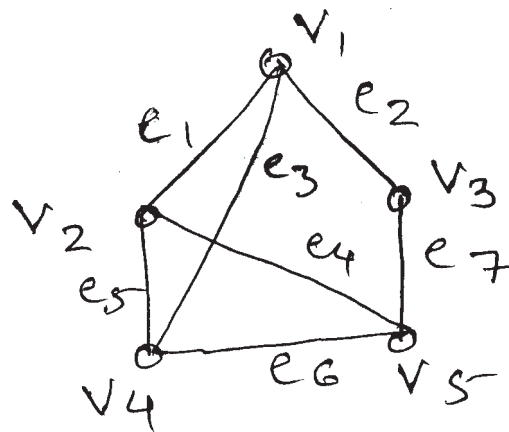
iii) Is it possible to draw a simple graph with 4 vertices and 7 edges? Justify.

Q5) a) Attempt <u>any one</u> of the following: **[1 × 6 = 6]**

   i) Prove that a graph G is a tree if and only if it is minimally connected.

   ii) Prove that a simple graph with n vertices and k components can have at most $\dfrac{(n-k)(n-k+1)}{2}$ edges.

   b) Attempt <u>any two</u> of the following: **[2 × 5 = 10]**

   i) Find the shortest path from 'a' to 'd' in the following graph.
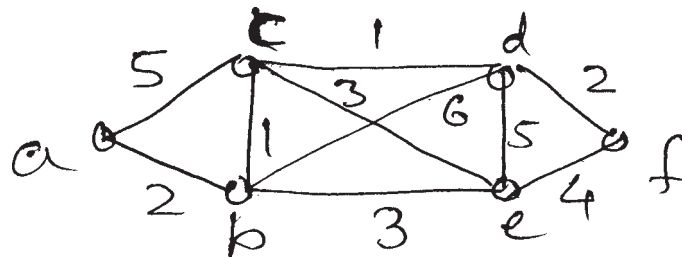
   ii) Let T be a binary tree with n vertices. Show that T has $\dfrac{n+1}{2}$ pendant vertices.

   iii) Use Fleury's algorithm to produce an Euler line in the following graph.
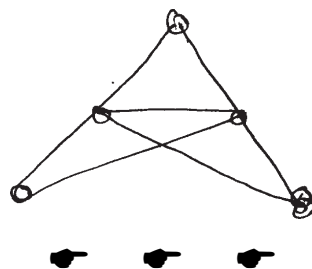
P1012　　　　　　　　　　**[3935] - 204**

M.Sc. Tech.

COMPUTER SCIENCE

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 204 : Database Fundamentals

(New Course) (2008 Pattern) (Sem. - II)

Time :3 Hours]　　　　　　　　　　　　　　　　　*[Max. Marks :80*

Instructions to the candidates:

1)　All questions are compulsory.

2)　Figures to the right indicate full marks.

Q1) Attempt <u>any eight</u> of the following:　　　　　　　　　　**[16]**

　　a)　State any 4 functions of a DBA.

　　b)　List 4 significant differences a file - processing system and a DBMS.

　　c)　Define a trigger.

　　d)　Define: Referential Integrity.

　　e)　What are joins? Give its type.

　　f)　State the full form of DML. Give any 2 statements given by SQL.

　　g)　Give the difference between the terms primary key, candidate key and superkey.

　　h)　Define: Attributes.

　　i)　What do you understand by aggregate functions in SQL?

　　j)　Define: Entity in ER model.

Q2) Attempt <u>any four</u> of the following:　　　　　　　　　　**[16]**

　　a)　Explain the system structure of a database system with a block diagram.

　　b)　Write a note on decomposition.

　　c)　Write a note on aggregation. Give an example.

　　d)　What is data model? Explain the types of data models in detail.

　　e)　What is logical data independence and why is it important?

Q3) Attempt <u>any four</u> of the following: **[16]**
    a)   Explain generalization and specializastion with suitable examples.
    b)   Explain functional dependency. Write briefly about closure in functional dependency.
    c)   Write a short note on: "Data abstraction and Data Independence" with an example.
    d)   Compute the closure of the following set F of functional dependencies for relation schema.

        R = (A, B, C, D, E).
            $A \rightarrow BC$
            $CD \rightarrow E$
            $B \rightarrow D$
            $E \rightarrow A$
        List the candidate keys for R.

    e)   Consider the following:
        Employer (eno, ename, salary, commission, dept No.);
        Department (dno, dname, location)
        Create a function to transfer all employees of department 'A' of location "AB", earning a commission of 30% of their salary to department "B". Also print the total number of employees shifted.

Q4) a)   Attempt <u>any one</u>: **[6]**
        i)   Consider the following relation schema

           employee (empno, name, office, age)

           books (isbn, title, anthors, publisher)

           loan (empno, isbn, data)

           Write the following queries in relational algebra:

           1)   Find the names of employees who have borrowed a book published by "Mc-Graw Hill".

           2)   For each publisher, find the names of employees who have borrowed more than five books of that publisher.

        ii)   Explain how Deletion operation is performed in Relational algebra.

    b)   Attempt <u>any two</u>: **[10]**
        i)   Write a short note on : Built - in Data types in SQL.

        ii)   Explain projection and cartesian product operation in relational algebra.

        iii)   Explain the difference between weak and strong entity set.

Q5) a)　Attempt <u>any one</u>:　　　　　　　　　　　　　　　　　　　**[6]**

　　i)　Consider the following relations.

　　　emp (<u>eno</u>, ename, dno)

　　　dept (<u>dno</u>, dname)

　　　proj (<u>pno</u>, pname, dno)

　　　e-p (eno, pno, hours)

　　　Write the following queries in SQL.

　　　1)　List the projects along with the total number of employees working in that project.

　　　2)　List the names of employees who are not working on any projects.

　　ii)　Write a short note on Normalization, with emphasis on INF,2NF, 3NF with examples.

　b)　Attempt any two:　　　　　　　　　　　　　　　　　　　　**[10]**

　　i)　Construct an E-R diagram for a hospital with a set of patients and a set of medical doctors. Associate with each patient a log of various tests and examinations conducted. Assume a set of attributes for each entity set.

　　ii)　Draw an ER diagram for a small driving school. The school offers driving lessons on three different vehicles like car, truck, two wheeler. The school offers courses like defensive driving, automobile mechines, high way code. Students get certificate from the school if they score minimum 75% in theory examination and minimum 80% in practical examination. If student fails then supplementary test is conducted. Students can pay the fees in installment. There are three type of employees in school like technical teachers, Instructors and administrators.

　　iii)　Write a note on cursors.

P1013   **[3935] - 205**

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 205 : Data Structures Using 'C'

(Sem. - II) (New) (2008 Pattern)

Time :3 Hours]   *[Max. Marks :80*

Instructions to the candidates:

   1)   All questions are compulsory.

   2)   Figures to the right indicate full marks.

Q1) Attempt any eight of the following: **[16]**

   a)   Explain the concept of data type.

   b)   What is stack overflow and stack underflow?

   c)   Transform following in fix expression to postfix

       $A - B / (C \wedge D) + (X + Y)$

   d)   Evaluate the following postfix expression

       $1\ 2\ 3 + *\ 7\ 8\ 3\ / -$

   e)   List any four applications of linked list.

   f)   Define following terms:

       i)   Degree of a nooh   ii)   Siblings

   g)   Give the node structure for a circular doubly linked list.

   h)   Distinguish between the tree and graph.

   i)   What is ADT? Give two examples of ADT.

   j)   Define descending priority queue.

Q2) Attempt any two of the following: **[16]**

   a)   Write a 'C' program to sort the elements in descending order using insertion sort.

       2 32 45 67 89 4 3 8 10

   b)   Write a 'C' program to multiply two polynomials using singly linked list.

   c)   Write a program to demonstrate breadth first search method of graph traversal.

Q3) Attempt any four of the following: [16]

    a)   Give the adjacency list representation for the following graph.
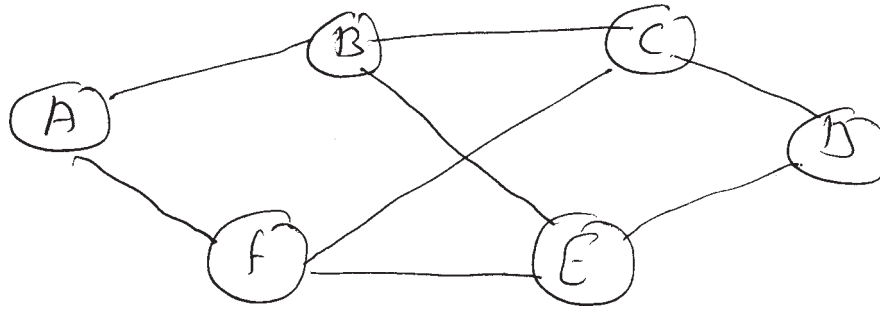
    b)   Explain the quick sort method with the help of the example.

    c)   Define the following:

        i)   Complete graph   ii)   Spanning tree

    d)   What is meant by traversing? List the different methods of node traversing.

    e)   Write note on arrays as an ADT.

Q4) Attempt any four of the following: [16]

    a)   Write a short note on binary search tree.

    b)   Differentiate between static and dynamic list.

    c)   What is queue? Explain different types of queues.

    d)   Explain in short any two applications of stack.

    e)   Write a 'C' program to implement bubble sort.

Q5) Answer any four of the following: [16]

    a)   Explain how a postfix expression can be evaluated using a stack.

    b)   Explain linear and non linear data structures with suitable example.

    c)   Define the following terms.

        i)   Doubly circular linked list.

        ii)   Static list.

    d)   Write a 'C' routine for searching an element in binary search tree.

    e)   Stack can be implemented as a linked list. Explain.

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[3935] - 301

M.Sc. Tech.

MATHEMATICS

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 301 : Numerical Analysis
(New Course) (Sem. - III) (2008 Pattern)

Time :3 Hours]   *[Max. Marks :80*

Instructions to the candidates:
- *1)   All questions are compulsory.*
- *2)   Figures to the right indicate full marks.*
- *3)   Use of non-programmable scientific calculator is allowed.*

Q1) Attempt <u>any eight</u> of the following: **[16]**
  a)   Find a root of the equation $x^3 - x - 4 = 0$, using bisection method which lies in [1, 2], correct to three decimal places.
  b)   Discuss ill conditioned system.
  c)   State Newton's general interpolation formula with divided differences.
  d)   Show that the matrix

$$A = \begin{bmatrix} -2/3 & 1/3 & 2/3 \\ 2/3 & 2/3 & 1/3 \\ 1/3 & -2/3 & 2/3 \end{bmatrix}$$

  is orthogonal matrix.

  e)   State Simpson's $\frac{3}{8}$ th Rule.

  f)   Evaluate $I = \int_0^1 \frac{1}{1+x} dx$

  Correct to three decimal places by the trapezoidal rule, where h = 0.5.
  g)   Obtain a root, correct to two decimal places for $x - \cos x = 0$ using Newton - Raphson method.
  h)   Show that $\delta^2 E = \Delta^2$, where operators have their usual meaning.
  i)   Define order of convergence.
  j)   Determine the eigen values of the matrix.

$$\begin{bmatrix} 2 & \sqrt{2} \\ \sqrt{2} & 1 \end{bmatrix}$$

Q2) a)   Attempt <u>any one</u> of the following: **[6]**
   i)   Obtain the Newton-Raphson formula to find the root of the equation
        $f(x) = 0$. Show that this method has a quadratic convergence.
   ii) Establish Newton's backward interpolation formula.

   b)   Attempt <u>any two</u> of the following: **[2 × 5 = 10]**
   i)   Solve the following system of non-linear equations by Newton-
        Raphson method.
        $x^2 - y^2 = 4, \qquad x^2 + y^2 = 16.$
   ii) Give the table of values

x	$y = \sqrt{x}$
150	12.247
152	12.329
154	12.410
156	12.490

        Evaluate $\sqrt{155}$ using Lagrange's interpolation formula.
   iii) Given the set of tabulated points $(1, -3), (3, 9), (4, 30)$ and $(6, 132)$.
        Obtain the value of y when $x = 2$ using Aitken's method.

Q3) a)   Attempt <u>any one</u> of the following: **[6]**
   i)   Derive closed Newton-Cotes formulas for integration.
   ii) Show that

$$f[x_0, x_1, ..., x_n] = \sum_{i=0}^{n} \frac{f(x_i)}{\prod_{\substack{j=0 \\ j \neq i}}^{n} (x_i - x_j)}$$

   b)   Attempt <u>any two</u> of the following: **[2 × 5 = 10]**
   i)   Solve the system
        $$2x_1 + x_2 - x_3 = -1$$
        $$x_1 - 2x_2 + 3x_3 = 9$$
        $$3x_1 - x_2 + 5x_3 = 14$$
        by Gauss elimination method
   ii) The following table gives the angular displacements θ (radians)
        at different intervals of time t (seconds)

θ	0.052	0.105	0.168	0.242	0.327	0.408	0.489
t	0	0.02	0.04	0.06	0.08	0.10	0.12

        Calculate the angular velocity at the instant $t = 0.06$

iii) Find the inverse of the matrix

$$A = \begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & 4 \\ 1 & 2 & 2 \end{bmatrix}$$

using Gauss elimination method.

Q4) a) Attempt <u>any one</u> of the following: [6]

i) Discuss modified Euler's method.

ii) Let $f(x)$ be a real valued function defined on the interval $[a, b]$ and k-times differentiable in (a, b), If x_0, x_1 --- x_k, are $(k + 1)$ distinct points in (a, b), then show that $\exists\ \xi \in (a, b)$ such that

$$f[x_0, x_1, ..., x_k] = \frac{F^k(\xi)}{k!}$$

b) Attempt <u>any two</u> of the following: [2 × 5 = 10]

i) Solve the following system

$$10x + 2y + z = 9$$
$$2x + 20y - 2z = -44$$
$$-2x + 3y + 10z = 22$$

by Jacobi's method. Carry your computations to two decimal places.

ii) Determine the largest eigenvalue and the corresponding eigenvector of the matrix.

$$\begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$$

iii) Using Picard's method find $y\ (0 - 1)$ for

$$\frac{dy}{dx} = x(1+x^3y),\ y(0)=3$$

Q5) a) Attempt <u>any one</u> of the following: [6]

i) Suppose $y(x)$ is a continuous function which is $(n+1)$ times differentiable in the interval (a, b). Given the $(n+1)$ points (x_0, y_0), (x_1, y_1) ..... (x_n, y_n), Find Lagrange's polynomial $L_n(x)$ of degree n such that

$$L_n(x_i) = y(x_i) = y_i;\ i = 0, 1, ..., n$$

ii) The following table of values of x and y where y is a cubic function of x

x	0	1	3	4
$f(x)$	1	4	40	85

Determine the function $f(x)$ and hence find $f'(2)$ and $f''(2)$

b) Attempt <u>any two</u> of the following: **[2 × 5 = 10]**

i) Reduce the following matrix to the tridiagonal form by Householder's method.

$$\begin{bmatrix} 1 & 3 & 4 \\ 3 & 1 & 2 \\ 4 & 2 & 1 \end{bmatrix}$$

ii) Use the Runge-Kutta four-order method to find the value of y when $x = 1$ given that $y = 1$ when $x = 0$ and

$$\frac{dy}{dx} = \frac{y - x}{y + x}$$

iii) Given that

$$\frac{dy}{dx} - \sqrt{xy} = 2, \quad y(1) = 1$$

Find the value of $y(2)$ in steps of 0.1 using Euler's modified method.

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P1015

[3935] - 302

M.Sc. Tech.

Industrial Mathematics with Computer Applications

MIM - 302 : Software Engineering (OOSE)

(New Course) (Sem. - III)

Time :3 Hours]   *[Max. Marks :80*

Instructions to the candidates:

1)   *Figures to the right indicate full marks.*

2)   *All questions carry equal marks.*

Q1) Attempt <u>any eight</u> of the following: **[16]**

   a)   Define process.

   b)   Give any 2 challenges facing software engineering.

   c)   What are critical systems?

   d)   Define: Feasibility study.

   e)   What is the difference between validation and verification?

   f)   Define : Test case.

   g)   Define : Prototyping.

   h)   Define : Client server Architecture.

   i)   What is a context model?

   j)   What are functional and Non-functional requirements?

Q2) Attempt <u>any four</u> of the following: **[16]**

   a)   Explain the attributes of a good software.

   b)   Explain Socio-technical systems.

   c)   Explain: Waterfall model

   d)   What do you mean by Requirements validation?

   e)   What are Evolutionary Process Models? Explain spiral model in brief.

Q3) Attempt <u>any four</u> of the following: **[16]**

   a) Explain system testing in detail.

   b) Give the stages of object oriented design.

   c) Explain Agile Methods.

   d) Explain how state machine model describes the internal and external event of a system.

   e) What are Extreme Programming? Explain in brief.

Q4) a) Attempt <u>any one</u> of the following: **[6]**

     i) Draw state machine models of the control software for an automatic washing machine that has different programs for different types of clothes. Assume the type of clothes and then define the state of the Machine. The state diagram for the above should define the complete system flow as per your assumption.

     ii) Draw a class diagram for the following: An employee in an organization is categorized as Manager and Programmer. The Manager is responsible for budget-control and date appointment. The Manager is also categorized as Project Manager, Department Manager and Strategic Manager. The programmer focuses on Project and programming languages.

   b) Attempt <u>any two</u> of the following: **[10]**

     i) Explain Rapid Application Development.

     ii) What are domain requirements? Explain in detail.

     iii) Explain the Factors in distributed object architecture.

Q5) Attempt <u>any four</u> of the following: **[16]**

   a) Explain : Component testing.

   b) Explain the purpose of Test automation.

   c) Explain the factors necessary for user analysis.

   d) What are the key aspects of a Behaviour model?

   e) List the rotations used in UML and explain the purpose with an example.

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P1015

[3935] - 302

M.Sc. Tech.

Industrial Mathematics with Computer Applications

MIM - 302 : Databases

(Old Course) (Sem. - III)

Time :3 Hours]   *[Max. Marks :80*

Instructions to the candidates:

    1)   *Neat diagrams must be drawn wherever necessary.*

    2)   *Figures to the right indicate full marks.*

Q1) Attempt any eight of following:

Define following terms: **[16]**

    a)   Relational database.

    b)   Schema.

    c)   Entity.

    d)   Tuple calculus.

    e)   Closure.

    f)   What are sequences?

    g)   What is functional dependency?

    h)   Explain the use of project (π) in relational Algebra.

    i)   Explain the use of 'having' clause in SQL.

    j)   Explain different set operators used in SQL.

Q2) a)   Attempt <u>any one</u>:   **[6]**

    i)   Consider Bus management system. In a depot different buses are scheduled to run on different Routes. Different drivers drive different buses everyday in their shifts. Information of driver as age, salary, name, address is maintained.

        1)   Find out different entities from the above.

        2)   Draw appropriate E-R Model.

    ii)   Write a short ntoe on B$^+$ tree organization.

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b) Attempt <u>any two</u>. **[10]**

    i) Explain in detail cursors in PL/SQL.

    ii) Differentiate between Relational Algebra and Relational Calculus.

    iii) What is Hashing? Explain Dynamic hashing.

Q3) a) Attempt <u>any one</u>: **[6]**

    i) What are aggregate functions used in SQL. Explain any 3 in detail.

    ii) Write a short note on Normalization.

b) Attempt <u>any two</u> of the following. **[10]**

    i) Consider the following database:

        Employee (<u>Eno</u>, Ename, Salary)

        Dept (<u>Dno</u>, Dname)

        Employee can work only in 1 department whereas a department can have many employees write the SQL statements for the following.

        1) Insert a record in Employee table.

        2) Update the salaries of employees by 10%.

        3) Show the details of employee having salary more than 5000.

        4) Delete the departments which names start with "ε".

        5) Show the list of employees working in 'Sales' department.

    ii) Explain the concept of stored functions.

    iii) What are different DDL statements?

Q4) a) Attempt <u>any one</u> of the following: **[6]**

    i) Write a note on

        1) Dynamic hashing.

        2) Extendible hashing.

    ii) Write a note on

        1) Primary key.

        2) Foreign key.

b) Attempt <u>any two</u> of the following: **[10]**

    i) Explain hierarchical data model.

    ii) Write a short note on E-R model.

    iii) In relational Algebra how grouping and ungrouping is performed.

Q5) Attempt <u>any four</u> of the following: **[16]**

    a)   Consider the following database

          Property (p_id, area, type)

          Owner (<u>id</u>, name, address)

          One owner can own many properties. Write the Relational Algebra statements for the following:

          i)   Find out owner details having address in 'kothrud' area.

          ii)   List the owners staying in 'camp'.

    b)   What are triggers? How triggers are declared in PL/SQL?

    c)   What is BCNF?

    d)   Explain 'cartesian product' and Rename operator in relational Algebra.

    e)   What are different types of entities? Explain with examples.

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P999

[3935] - 45

M.Sc. Tech.

MATHEMATICS

Industrial Mathematics with Computer Applications

MIM - 405 : Design and Analysis of Algorithms - II

(Old) (Sem. - IV) (2005 Pattern)

Time :3 Hours]   *[Max. Marks :80*

Instructions to the candidates:

    1)   *Figures to the right indicate full marks.*

    2)   *All questions are compulsory.*

Q1) Attempt any <u>EIGHT</u> of the following: **[8 × 2 = 16]**

    a)   Show that if a|b & b|c then a|c.

    b)   Define P and NP class.

    c)   What is vertex cover problem?

    d)   State chinese remainder theorem.

    e)   What is LUP decomposition?

    f)   What is digital signature?

    g)   What is principal n^{th} root of unity?

    h)   Define : ERCW and CREW.

    i)   What is full adder?

    j)   What is bounding box?

Q2) a)   Attempt any <u>one</u> of the following: **[1 × 6 = 6]**

      i)   State and prove zero-one principle.

      ii)   State and prove discrete logarithm theorem.

    b)   Attempt any <u>two</u> of the following: **[2 × 5 = 10]**

      i)   Explain the RSA cryptosystem.

      ii)   Explain Modular - exponentiation algorithm.

      iii)   Find LU decomposition of the following matrix

$$\begin{bmatrix} 4 & -5 & 6 \\ 8 & -6 & 7 \\ 12 & -7 & 12 \end{bmatrix}$$

Q3) a) Attempt any <u>one</u> of the following: **[1 × 6 = 6]**

    i) What is bitonic sequence? Explain Bitonic Sorting. Show that Bitonic sorter (n) where n is an exact power of 2 contains n log n comparisons.

    ii) How are the three processors connected in a Euler -- tour formation in a EREW PRAM? What are their initial values? How is it used to compute node depths?

  b) Attempt any <u>two</u> of the following: **[2 × 5 = 10]**

    i) If L_1, $L_2 \subseteq \{0, 1\}^*$ are languages such that $L_1 \le PL_2$ then prove that if $L_2 \in P$ implies that $L_1 \in P$

    ii) Explain the modular exponentiation algorithm and show the results when computing a^b where a = 7; b = 18 n = 13

    iii) Explain the kruth-morris-pratt pattern matching algorithm.

Q4) a) Attempt any <u>one</u> of the following: **[1 × 6 = 6]**

    i) Discuss the greedy Approximation algorithm for solving the set covering problem.

    ii) Discuss Gram's scan method to solve convex hull problem.

  b) Attempt any <u>two</u> of the following: **[2 × 5 = 10]**

    i) Compute the matrix product using strassen's algorithm for the following matrices

$$A = \begin{bmatrix} 5 & 3 \\ 2 & 1 \end{bmatrix} \quad B = \begin{bmatrix} 4 & 7 \\ 1 & 6 \end{bmatrix}$$

    ii) What is triangle inequality? Give the approximation algorithm for travelling salesperson problem with triangle in equality.

    iii) Give modular equation solver algorithm and use it to solve the equation $28 x = 8 \bmod 56$.

Q5) a) Attempt any <u>one</u> of the following: **[1 × 6 = 6]**

    i) Prove that circuit satisfiability problem belongs to NP class.

    ii) Write an algorithm to find closest pair of points in the given set of points.

  b) Attempt any <u>two</u> of the following: **[2 × 5 = 10]**

    i) Explain the recursive fast fourier transformation (FFT) algorithm.

    ii) Explain the steps of computing matrix inverse of A using LUP decomposition.

    iii) Explain carry - save addition. Where it is effectively used?

P1000

[3935] - 51
M.Sc. Tech. (Sem. - V)
COMPUTER SCIENCE
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 501 : Compiler Techniques
(Old Course) (2005 Pattern)

Time : 3 Hours]   *[Max. Marks : 80*
Instructions to the candidates:
  1)   All questions are compulsory and carry equal marks.
  2)   Write your assumptions clearly, if any.

Q1) Attempt <u>any eight</u> of the following :   **[16]**
  a)   Define a compiler.
  b)   What is a sentinel?
  c)   What is parsing?
  d)   'Number of states of SLR parse table are same as that of canonical LR parse table'. Comment on this statement.
  e)   Define scope rules of a block structured language.
  f)   What is an attribute grammar.
  g)   Define lifetime of activation of a procedure.
  h)   What is the purpose of doing code optimisation.
  i)   What are the actions performed by a LR parser?
  j)   'A syntax directed definition does not provide semantic rule for a terminal'. Is it true or false. Why?

Q2) a)   Attempt <u>any one</u> of the following :   **[6]**
  i)   Write a Recursive Descent parser for the following grammar.
       $S \rightarrow aA / bB / ab \qquad A \rightarrow a / b \qquad B \rightarrow bA / a$
  ii) Check if following grammar is LL(1) or not
       $E \rightarrow TE' \qquad E' \rightarrow + TE'/\in$
       $T \rightarrow FT' \qquad T' \rightarrow *FT'/\in$
       $F \rightarrow (E) / id$

P.T.O.

b) Attempt <u>any two</u> of the following :   **[10]**
    i)   Define a deterministic finite automata. What is its role in scanning? Explain with suitable eg.
    ii) Explain the contents of activation record.
    iii) Draw a directed acyclic graph for expression
         a + a * (b − c) + (b − c) * d.

Q3) a) Attempt <u>any one</u> of the following :   **[6]**
    i)   Compute LALR (1) items for following grammar.
         S → AA   A → aA/b
    ii) Compute LR(0) item sets for the following grammar.
         S → A/B   A → aA/b   B → dB/b
    b) Attempt <u>any two</u> of the following :   **[10]**
    i)   Write a note on analysis phase of a compiler.
    ii) Explain how compiler handles a while loop and a for loop for compilation.
    iii) Write a note on dynamic memory allocation.

Q4) Attempt <u>any four</u> of the following :   **[16]**
    a) Explain bootstrapping and cross compiler.
    b) Write a note on input bufferring.
    c) Explain the drawbacks of top-down parsing with back tracking.
    d) Write a note on static storage allocation.
    e) Explain the following methods of code optimisation with suitable examples.
        i)   frequency reduction
        ii) dead code elimination

Q5) Attempt <u>any four</u> of the following :   **[16]**
    a) Explain different types of conflicts observed in LR parsing with suitable examples.
    b) Write a note on call by value method for passing parameters to a procedure.
    c) Explain the concept of displays with suitable example.
    d) What are the functions performed by a scanner?
    e) What is an expression tree? Explain with suitable examples.

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P1001

[3935]-52

M.Sc.Tech

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM-502 : Software Engineering - I
(Sem.-V) (Old Course) (2005 Pattern)

Time : 3 Hours] *[Max. Marks : 80*
Instructions to the candidates:
    1)   *All questions are compulsory.*
    2)   *Figures to the right indicate full marks.*

Q1) Attempt <u>any eight</u> of the following: **[16]**

    a)   Why we require Software Engineering?

    b)   State any 2 applications of software.

    c)   Define: Cohesion.

    d)   Give any 2 Characteristics of a good quality design.

    e)   What do you understand by process model?

    f)   How to calculate the cost of quality?

    g)   Give the characteristics of a use case diagram.

    h)   Give any 2 factors that are used to construct a system model.

    i)   Define: Abstraction.

    j)   Give any 2 parameters used to access the quality of a software.

Q2) Attempt <u>any four</u> of the following: **[16]**

    a)   Explain the major activities involved in spiral model.

    b)   Write a short note on: Incremental process model.

    c)   Explain: System Development Life Cycle.

    d)   Explain the purpose of "Decision Table" and give suitable example.

    e)   Explain the different Requirement analysis methods.

Q3) Attempt <u>any four</u> of the following: **[16]**

    a)   Explain the principles of testing methodology in detail.

    b)   Write a brief note on : Information hiding.

    c)   State the difference between concurrent and component based approach.

    d)   Explain 4GL Approach with an example.

    e)   Explain the difference between Testing and Debugging.

P.T.O.

Q4) Attempt <u>any two</u> of the following: [16]

    a)   Consider the casestudy and draw the data flow diagram with assumptions.

            A car insurance company wants to automate system. The system includes database of the customers i.e, car owners, accidents and drivers involved in accidents. The system also maintains information about injured drivers and passengers. The company provides information to the agencies wherever required.When a car is sold the information regarding the same enters in the database and various reports are generated. The company also includes reminders to be send to the customers regarding premium.

    b)   Explain Aggregation and composition with an example.

    c)   Draw the state diagram for a telephone answering machine that records incoming messages and displays the number of accepted messages on an LED display. The system should allow the telephone owner to dial in, type a sequence of numbers and have the recorded messages replayed over the phone.

Q5) Attempt <u>any four</u> of the following: [16]

    a)   Differentiate between Reverse engineering and Re-engineering.

    b)   Explain Validation testing.

    c)   Write a note on: Effective Modularity in System Design.

    d)   Write a note on : Object Model

    e)   Explain the difference between waterfall Model and Prototyping Model.

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P1002

[3935] - 53
M.Sc. Tech. (Sem. - V)
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 503 : Computer Networks
(2005 Pattern) (Old Course)

Time : 3 Hours]　　　　　　　　　　　　　　　　　　*[Max. Marks : 80*

Instructions to the candidates:

　　1) All questions are compulsory.

　　2) Figures to the right indicate full marks.

Q1) Attempt <u>any eight</u> of the following :　　　　　　　　　**[16]**

　　a) State any two advantages of coaxial cable.

　　b) State the Nyquist theorem for noiseless channel.

　　c) What is the purpose of the transport layer?

　　d) State the difference between pure and slotted ALOHA.

　　e) What are the default masks for class B and class C IP addresses?

　　f) What is the purpose of D and M flags in the IPv4 packet?

　　g) List the various service primitives in ISO-OSI model.

　　h) Which application layer protocols use TCP?

　　i) List the various types of Ethernet.

　　j) What is the difference between de-facto and de-jure standards?

Q2) a) Attempt <u>any one</u> of the following :　　　　　　　　　**[6]**

　　　　i) Explain any one method of random access mechanism in MAC layer.

　　　　ii) Write a note on IPv4 addressing and explain how subnets are created.

　　b) Attempt <u>any two</u> of the following :　　　　　　　　　**[10]**

　　　　i) Write the differences between FDM and TDM.

　　　　ii) Explain how telnet works.

　　　　iii) Explain various topologies used in LAN's.

P.T.O.

Q3) a) Attempt <u>any one</u> of the following :   **[6]**
  i)   Explain how Ethernet works.
  ii) Explain the TCP/IP reference model in brief.

  b) Attempt <u>any two</u> of the following :   **[10]**
  i)   Differentiate between Message passing and packet passing switched. networks.
  ii) Explain how a bridge works with an example.
  iii) Explain the architecture of IEEE 802.11.

Q4) a) Attempt <u>any one</u> of the following :   **[6]**
  i)   Draw the format and explain the fields of a TCP packet.
  ii) What is routing? Explain the characteristics of a good routing algorithm.

  b) Attempt <u>any two</u> of the following :   **[10]**
  i)   Write a note on CSMA/CA.
  ii) Explain the encoding mechanisms used in the physical layer.
  iii) Explain data and control connection in FTP.

Q5) Attempt <u>any four</u> of the following :   **[16]**
  a) For the following IP address, find its class, default mask. Also calculate the subnet mask if the network has 4 subnets.
      IP address : 192.10.200.54
  b) Encode the data 1010110 using straight binary, Manchester, differential Manchester and NRZ encoding.
  c) Calculate the data rate for a noiseless channel having 8 kHz bandwidth and 64 levels of signaling.
  d) Show the three-way handshake between Host A and Host B assuming that A uses sequence number 2000. Which flags are used?
  e) An IPv4 datagram has header length of 6. Calculate the header length in no. of bytes. If the datagram is fragmented and $M = 1$, is this the last or middle fragment? Justify. What will be the identification number if the packet carries byte numbers 100 to 200?

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P1003

[3935] - 54
M.Sc. Tech. (Sem. - V)
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 504 : Computer Graphics
(Old Course) (2005 Pattern)

Time : 3 Hours]   *[Max. Marks : 80*

Instructions to the candidates:
1) *Figures to the right indicate full marks.*
2) *All questions are compulsory.*
3) *Use of non-programmable scientific calculator is allowed.*

Q1) Attempt <u>any eight</u> of the following :   **[8 × 2 = 16]**

   a)   Describe any two application areas where computer graphics is used.

   b)   What is horizontal and vertical retrace?

   c)   What is reflection? Give the transformation matrix for reflection about the line $y = x$.

   d)   Why line clipping algorithms cannot be used for polygon clipping by considering polygon as collection of lines.

   e)   What are the two types of parallel projections?

   f)   Windows to viewport transformation is a composite of basic transformations. Justify.

   g)   If the lookup table of a raster device is 8 bits aide and having 6 bit planes. How many entries are in the lookup table? How many intensities are available?

   h)   What is a 'Data-Glove'?

   i)   What is a vanishing point? How many principal vanishing points can a scene contain?

   j)   How surfaces are ordered in depth sorting method? Why is it called painter's algorithm?

Q2) a)   Attempt <u>any one</u> of the following :   **[1 × 6 = 6]**

     i)   Explain the two methods of producing color display in CRT.

     ii)   Explain the algorithm for general pivot point rotation and general fixed point scaling.

                                           P.T.O.

b) Attempt <u>any two</u> of the following : **[2 × 5 = 10]**

    i) Explain DDA algorithm. Why is it not efficient?

    ii) Write a short note on touch panel as interactive graphics device.

    iii) Explain Edge fill algorithm. Explain how the number of pixels can be reduced by introducing a fence.

Q3) a) Attempt <u>any one</u> of the following : **[1 × 6 = 6]**

    i) A six sided polygonal clipping window is shown below. Illustrate the complete result of the cyrus-beck algorithm for the line $P_1(-1, 2)$ and $P_2(3, 3)$.
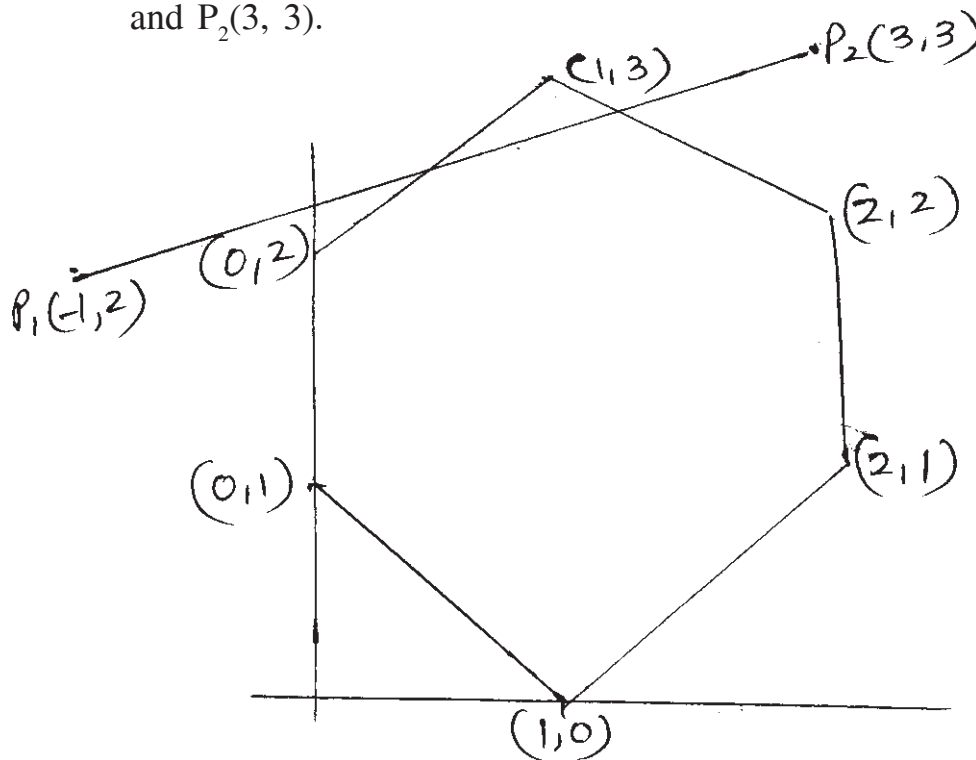
    ii) Illustrate the general Bresenham's line drawing algorithm for $P_1 = (2, 3)$ and $P_2 = (-7, 5)$.

b) Attempt <u>any two</u> of the following : **[2 × 5 = 10]**

    i) How random scan line display differs from raster scan line display? Explain Random scan line drawing algorithm.

    ii) Consider an object having its center at (5, 2). Give the transformation matrix for

        1) rotating the object 90° counter clockwise about its center.

        2) x shear with $shx = 2$.

    iii) Explain cohen-sutherland clipping algorithm.

Q4) a)   Attempt <u>any one</u> of the following :   **[1 × 6 = 6]**

     i)   Discuss the properties of Bezier curves.

     ii) Obtain blending functions for open uniform B splines with $d = 3$ and $n = 3$.

  b)   Attempt <u>any two</u> of the following :   **[2 × 5 = 10]**

     i)   Explain the following terms : control points, zero-order continuity, convex hull, cubic splines, and quadric surfaces.

     ii) Explain flood fill algorithm.

     iii) Write a short note on perspective projections.

Q5) Attempt <u>any four</u> of the following :   **[4 × 4 = 16]**

  a)   Discuss Area subdivision algorithm for hidden surface elimination.

  b)   Discuss in detail the z-buffer Algorithm.

  c)   Explain cavalier and caloinet projections.

  d)   Write a note on uniform and non uniform B-splines.

  e)   Rotate polygon A = (–1, 0) B = (0, –2), C = (1, 0) and D = (0, 2) about the line $y = x + 1$.

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[3935] - 101

M.Sc. Tech. (Sem. - I)

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 101 : Real Analysis
(2008 Pattern) (New)

Time : 3 Hours]   *[Max. Marks : 80*

Instructions to the candidates:

  1)   All questions are compulsory.

  2)   Figures to right indicate full marks.

Q1) Attempt <u>any EIGHT</u> of the following :   **[16]**

  a)   Prove that the interior of a set is an open set in a metric space.

  b)   Is the following statement true :

   'In a metric space, arbitrary union of closed sets is closed'. Justify your answer.

  c)   Find closures of the following sets in R.

   i) $\left\{ \dfrac{1}{n} \, / \, n \in \mathbf{N} \right\}$.

   ii)   Q : Set of rational numbers.

  d)   Show that a closed set in a compact metric space X is compact.

  e)   Suppose $d : \mathbf{R} \times \mathbf{R} \to \mathbf{R}$ is defined as

   $$d(x, y) = \begin{cases} 0 & , \;\; if \;\; x = y \\ 3 & , \;\; if \;\; x \neq y \end{cases}$$

   Is 'd' a metric on R?

  f)   Prove that if $f_1 \in \mathrm{R}(\alpha), f_2 \in \mathrm{R}(\alpha)$ then their product $f_1 \cdot f_2 \in \mathrm{R}(\alpha)$.

  g)   Discuss the convergence of the series $\displaystyle\sum_{n=1}^{\infty} \dfrac{n^3}{e^n}$.

  h)   Explain what do you mean by discontinuity of second kind of a function by giving suitable example.

  i)   Let f be a continuous function on $[a, b]$. Prove that there exists $c \in (a, b)$

   Such that, $\displaystyle\int_a^b f(x)\,dx = f(c)\,(b - a)$.

                    P.T.O.

j) Show that the sequence $f_n(x) = \dfrac{1}{x+n}$

defined on $[0, \infty)$ is uniformly convergent.

Q2) a) Attempt <u>any ONE</u> of the following : **[6]**

   i) Let E be a subset of a metric space (X, d). Show that $\overline{E}$, the closure of E is closed set in X.

   ii) Define compact subset of a metric space. Prove that, compact subsets of a metric space are closed.

b) Attempt <u>any TWO</u> of the following : **[10]**

   i) Let $S_1 = 1$ and $S_{n+1} = \sqrt{2+S_n}$, $\forall n = 1,2,......$

   show that the sequence $\{S_n\}$ is Monotonically increasing and bounded in R.

   ii) Give an example of an open cover of $(0, 1)$ which has no finite subcover.

   iii) Let $f : X \to Y$ be a mapping of a metric space X into a metric space Y. Show that f is continuous on X if and only if $f^{-1}(G)$ is open set in X whenever G is an open set in Y.

Q3) a) Attempt <u>any ONE</u> of the following : **[6]**

   i) Show that a continuous map from a compact metric space X into a metric space Y is uniformly continuous.

   ii) Let f be a continuous mapping from a metric space X into a metric space Y. Let E be a connected subset of X. Show that $f(E)$ is a connected subset of Y.

b) Attempt <u>any TWO</u> of the following : **[10]**

   i) Verify mean value theorems for the functions $f(x) = \dfrac{1}{x^2}$ and

   $g(x) = \dfrac{1}{x}$ in $[a, b]$, $a > 0$.

   ii) Let E be a connected subset of a metric space X and $F \subset X$; such that $E \subset F \subset \overline{E}$ then prove that F is connected.

   iii) Show that if f is a continuous real valued function on $[a, b]$ then $f \in R(\alpha)$ on $[a, b]$.

Q4) a)   Attempt <u>any ONE</u> of the following :   **[6]**

      i)   With usual notations, prove that if $p*$ is a refinement of p then, $L(p, f, \alpha) \le L(p*, f, \alpha)$.

      ii)   If $f \in R(\alpha)$ on $[a, b]$ and F is differentiable function on $[a, b]$

            such that $F' = f$ then prove that $\int_a^b f(x)dx = F(b) - F(a)$.

   b)   Attempt <u>any TWO</u> of the following :   **[10]**

      i)   State and prove Taylor's theorem for a functions of real variable.

      ii)   If $f(x) = x^4 + x^3 - x^2 + 1$, $\alpha(x) = x$ on $[0, 1]$.

            Find $\int_0^1 f.d\alpha$

      iii)   State and prove the implicit function theorem.

Q5) Attempt <u>any FOUR</u> of the following :   **[16]**

   a)   Let $f_1, f_2 \in R(\alpha)$ on $[a, b]$ and $\alpha, \beta \in R$ then prove that, $\alpha f_1 + \beta f_2 \in R(\alpha)$ on $[a, b]$.

   b)   If $\{f_n\}$ is a sequence of continuous functions on E and if $f_n \to f$ uniformly on E then prove that f is continuous on E.

   c)   Suppose f is continuous mapping of a compact metric space X into a metric space Y, then show that $f(X)$ is compact.

   d)   If $f : [a, b] \to R$ is differentiable and $f'(a) < \lambda < f'(b)$ then prove that $\exists\, x \in (a, b)$ such that $f'(x) = \lambda$.

   e)   Show that the sequence $f_n(x) = \dfrac{\sin nx}{\sqrt{n}}$ is uniformly convergent on

      $[0, 2\pi]$.

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P1008

[3935]-105

M.Sc.Tech.

Industrial Mathematics with Computer Applications

MIM-105 : Elements of Information Technology

(Sem.-I) (New Course) (2008 Pattern)

Time : 3 Hours]   *[Max. Marks : 80*

Instructions to the candidates:

    1)   *Figures to the right indicate full marks.*

    2)   *Use of logarithmic tables calculator is allowed.*

    3)   *All questions are compulsory.*

Q1) Attempt any EIGHT of the following: **[16]**

    a)   Distinguish between application software & system software.

    b)   State types of ROM.

    c)   State any two applications of Network.

    d)   Define the term "access time" of a memory.

    e)   Give any two features of operating system.

    f)   Define multitasking & multi programming operating system.

    g)   Define ASCII code. How ASCII-7 is different from ASCII-8.

    h)   State functions of MAN.

    i)   Define a record.

    j)   Differentiate variable & fixed length records.

Q2) Attempt any four of the following: **[16]**

    a)   Discuss with necessary diagram the working of Dot Matrix printer.

    b)   Explain performance parameters of computer.

    c)   Convert following numbers to decimal.

        i) $(D6C1)_{16}$

        ii) $(0.9)_{16}$

    d)   Explain construction & working of floppy disk.

    e)   Write note on fourth generation of computers.

Q3) Attempt any four of the following: [16]

    a) Explain indexed sequential file organization.

    b) Give applications of information technology.

    c) What is a real time operating system? State its application.

    d) What is topology? Explain star topology.

    e) Explain working principles of inkjet printer.

Q4) Attempt any four of the following: [16]

    a) Convert following numbers to decimal.

        i) $(1111.0101)_2$

        ii) $(11111011)_2$

    b) Distinguish between MAN & WAN.

    c) Define operating system. Give functions. of operating system.

    d) Discuss working of CD- ROM drive.

    e) Give types of computer. State advantages & disadvantages of super computer.

Q5) Attempt any two of the following: [16]

    a) State different communication medias. Write note on co-axial cable.

    b) State types of storage devices. Explain any one in detail.

    c) Explain multiprogramming operating system. How it is different from time sharing operating system. Give advantage & disadvantage of multiprogramming over batch operating. System.

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P1016

[3935] - 303
M.Sc. Tech (Sem. - III)
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 303 : Object Oriented Programming with Java
(New Course) (2008 Pattern)

Time : 3 Hours]   *[Max. Marks : 80*

Instructions to the candidates:

1) *Neat diagrams must be drawn wherever necessary.*
2) *Figures to the right indicate full marks.*

Q1) Attempt <u>any eight</u> of the following :   **[16]**

    a) What is 'Javac' tool? Explain its use.

    b) What is polymorphism?

    c) Define encapsulation.

    d) How to declare 2 dimensional array in Java?

    e) What is wrapper class? Why they are used?

    f) What is an interface?

    g) What are final classes? Explain its use.

    h) What is the use of finally block?

    i) Explain : i)   event source.

                 ii)   event listener.

    j) What are result sets in java? What are different types of result sets?

Q2) Attempt <u>any four</u> of the following :   **[16]**

    a) What is an exception? Explain user defined exceptions with example.

    b) What are the different types of JDBC drivers?

    c) What are layout managers? Explain any 2 layout managers.

    d) What is a package? How packages are defined in Java? Give suitable example?

    e) What are different access specifiers used in Java? Explain.

P.T.O.

Q3) Attempt <u>any two</u> of the following : **[16]**

   a) Write a program to define two different linked lists to store integer data. Accept 'n' numbers from the user and store in linked list as odd numbers in 1 linked list and even numbers in other linked list.
   Show the output of both the linked lists.

   b) Create a GUI based program containing list box, TexBox. list any 5 city names in list box. When any name in the list box will be selected, show its reverse in the text box.

   c) Write a program to accept details of a person name, address, age. Throw the exception if
   i) age is less than 0. 'Negative not allowed'.
   ii) age is between 0 to 18 'you are minor'.

Q4) Attempt <u>any two</u> of the following : **[16]**

   a) Write a program to accept file names through command line arguments. Check if that file exists if yes, then show file name with file size and file path. If file does not exist show the appropriate message.

   b) Define a class Employee (e.no, e name, e-salary). Derive two classes as teaching and non teaching storing 'designation'. Define appropriate functions to accept data from the user. Also define a function to compare the salaries of employees. Show the employee details having max salary from teaching and non teaching.

   c) Write a program to accept 'n' numbers from the user through command line argument. Store them in array perform following operations on array and show the output.
   i) Reverse array.
   ii) Add all array elements and show the result.
   iii) Find minimum and maximum of array.

Q5) Attempt <u>any four</u> of the following : **[16]**

   a) Define following terms :
   i) method overloading.
   ii) method overriding.

b)   Differentiate : do ...while and while loop. Give suitable example.

c)   What are different types of variables in Java? Define the scope of variables.

d)   For each of the following write a single statement code :

   i)   To find a substring of a string.

   ii)   Find out length of a string.

   iii)   Check if the string stri1 ends with 'ion'.

   iv)   Compare two strings for their contents.

e)   What is Garbage collection in Java?

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P1017

[3935]-304

M.Sc. Tech

COMPUTER SCIENCE

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATION

MIM - 304 : Operating Systems

(Sem. - III) (New Course)

Time : 3 Hours]   *Max. Marks : 80*

Instructions to the candidates:

1) *Neat diagrams must be drawn wherever necessary.*
2) *Figures to the right idicate full marks.*
3) *All questions carry equal marks.*
4) *All questions are compulsory.*

Q1) Attempt <u>any eight</u> of the following: [8 × 2 = 16]

a) Define : symmetric multiprocessing and asymmetric multiprocessing.

b) Describe two important functions of virtual file system (VFS).

c) Define the terms : job queue and ready queue.

d) Explain the sequence in which process utilize a resource, under the normal mode of operation.

e) Give any two benefits of multithreaded program.

f) What is race condition? Explain with example.

g) State the functionality of clocks and timers used in computer hardware.

h) Define : logical - address space and physical address space.

i) Write a note on dynamic loading.

j) Explain the error handling module of kernel I / O subsystem.

Q2) a) Attempt <u>any one</u> of the following: [1 × 6 = 6]

i) Consider the following snapshot of a system :

Job	Arrival Time	CPU Burst Time
J_1	0	4
J_2	2	3
J_3	1	7
J_4	3	15

compute turn around time, waiting time, average turn around time, average waiting time using non preemptive SJF . Also show the contents of Gantt chart.

ii) Write a note on resource allocation graph.

P.T.O.

b) Attempt <u>any two</u> of the following : [2 × 5 = 10]
i) Consider the following reference string :
4, 3, 2, 1, 4, 3, 5, 4, 3, 2, 1, 5. How many page fault occurs for the following algorithms with 3 page frames.
1) LRU.
2) Optimal.
ii) Explain in detail - process state diagram.
iii) What is deadlock? Explain necessary conditions for deadlock to occur.

Q3) Attempt <u>any four</u> of the following: [4 × 4 = 16]
a) What is system program? Explain shell as a system program.
b) Write a note on sequential and direct access methods.
c) Define the following terms :
i) Turn around time.
ii) Response time.
iii) Waiting time.
iv) Through put.
d) Explain one - to - one and many - to - one multithreading models.
e) Discuss reader - writer problem with the necessary example.

Q4) Attempt <u>any four</u> of the following: [4 × 4 = 16]
a) Explain the various operations to be performed on the directory.
b) Discuss the various system calls used in file management.
c) What is the draw back of paging and segmentation? Explain paging with segmentation.
d) Write a note on cooperating process and independent process.
e) Explain all the steps in DMA transfer.

Q5) Attempt <u>any four</u> of the following: [4 × 4 = 16]
a) Consider the following snapshot of a system.

	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P_0	0	1	1	3	2	1	1	0	2
P_1	3	3	2	4	3	2			
P_2	1	3	4	2	3	4			
P_3	3	2	1	3	3	3			
P_4	1	1	1	1	2	3			

Answer using banker's algorithm. Is the system in a safe state?

b) Write a note on linked allocation and index allocation methods.

c) Explain multiprogrammed systems.

d) Define the following terms used in polling:
   i) Busy bit.
   ii) Write bit.
   iii) Command - ready bit.
   iv) Error bit.

e) Explain the role of Test and Set instructions used in synchronization hardware

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P1018

[3935] - 305
M.Sc. Tech.
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 305 : Theoretical Computer Science
(New Course) (2008 Pattern) (Sem. - III)

Time : 3 Hours]   *[Max. Marks : 80*

Instructions to the candidates:
   1)   All questions are compulsory.
   2)   Figures to the right indicate full marks.

Q1) Attempt <u>any eight</u> of the following :   **[8 × 2 = 16]**
   a)   Define a finite state machine.
   b)   Construct DFA for the language over the alphabet {0, 1} with even number of zeros.
   c)   Construct NFA with ∈ moves for the following regular expression : 01*.
   d)   Find the language generated by CFG
         S → aSb | ∈ .
   e)   Show that the grammar given below is ambiguous : S → SS | a |b.
   f)   Eliminate ∈ productions from the following CFG :
        A → aBb | b B b
        B → aB | b B | ∈
   g)   Eliminate unit productions from the following CFG :
        S → AB | a, A → C | d, C → b
   h)   Write regular expression to accept all strings starting and ending with b and consisting of any no. of 'a' s over alphabet {a, b}.
   i)   Define ∈ -closure of a state.
   j)   Define ID of a Turing Machine.

Q2) a)   Attempt <u>any one</u> of the following :   **[1 × 6 = 6]**
        i)   Design a moore machine for a language over the alphabet {0, 1} which outputs ∗ if string contains '11' in it and outputs # otherwise. Convert it into a mealy machine.

P.T.O.

ii) Minimize the following DFA :

M = ({A, B, C, D, E, F, G, H}, {0, 1}, δ, A, {D})

δ	0	1
→ A	B	A
B	A	C
C	D	B
* D	D	A
E	D	F
F	G	E
G	F	G
H	G	D

b) Attempt <u>any two</u> of the following :　　　　　　　　　　　**[2 × 5 = 10]**

i) Prove that $\forall n \geq 0$,

$$1 + \sum_{i=1}^{n} i.i\,! = (n+1)!$$

ii) Design a FA which checks whether a given binary number is divisible by 3. The binary number will be given from MSB to LSB.

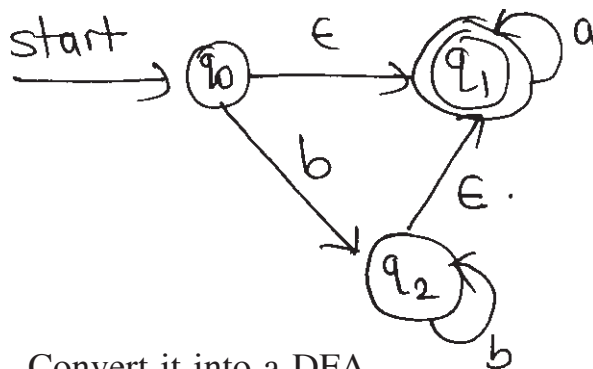iii) Consider NFA whose transition table is as given below :

δ	a	b
→ 1	{1, 2}	{1}
2	{3, 4}	{5}
3	{1, 3}	{5}
* 4	ϕ	ϕ
* 5	ϕ	ϕ

Convert it into a DFA.

Q3) a) Attempt <u>any one</u> of the following :　　　　　　　　　　　**[1 × 6 = 6]**

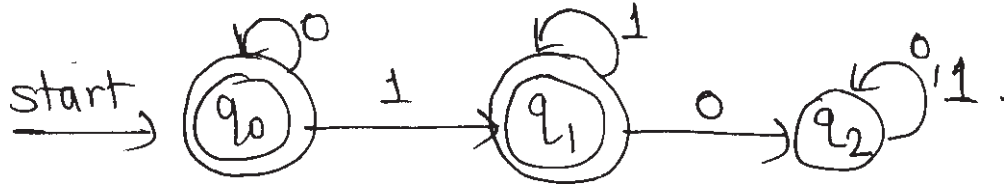i) Consider ∈-NFA whose transition diagram is as given below :

Convert it into a DFA.

ii) Construct FA for the following regular expression :
$(0 + 1)^* (1 + 00) (0 + 1)^*$.

b) Attempt <u>any two</u> of the following : **[2 × 5 = 10]**

i) Find regular expression for the FA whose transition diagram is as given below :

ii) Show that L = {$0^i 1^j$ | j = 2i, i & j are integers} is not regular.

iii) Construct grammar for the language L = {$a^j b^n c^n$ | n ≥ 1, j ≥ 0}

Q4) a) Attempt <u>any one</u> of the following : **[1 × 6 = 6]**

i) Convert the following CFG into CNF :
S → ABA
A → aA | ∈
B → bB | ∈.

ii) Convert the following CFG into GNF :
S → AA | 0
A → SS | 1.

b) Attempt <u>any two</u> of the following : **[2 × 5 = 10]**

i) Construct regular grammar for the FA whose transition diagram is as given below :
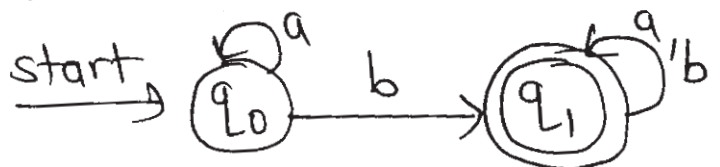
ii) Convert the following right linear grammar to left linear grammer:
S → bB
B → bC | aB
C → a
B → a

iii) Construct PDA that accepts language
L = {$a^n b^m a^n$ | m, n ≥ 1}.

Q5) a) Attempt <u>any one</u> of the following : **[1 × 6 = 6]**

    i) Construct PDA for the following grammar :

        $S \rightarrow OAC$

        $A \rightarrow OAC \mid 1B \mid 1$

        $B \rightarrow \mid B \mid 1$

        $C \rightarrow 1$

    ii) Construct a CFG which generates the language accepted by the following PDA :

        $A = (\{q_0, q_1\}, \{a, b\}, \{Z, Z_0\}, \delta, q_0 \, Z_0, \phi)$

        Where δ is given by,

            $\delta \, (q_0, b, Z_0) = (q_0, ZZo)$

            $\delta \, (q_0, \in, Z_0) = (q_0, \in)$

            $\delta \, (q_0, b, Z) = (q_0, ZZ)$

            $\delta \, (q_0, a, Z) = (q_1, Z)$

            $\delta \, (q_1, b, Z) = (q_1, \in)$

            $\delta \, (q_1, a, Z_0) = (q_0, Zo).$

  b) Attempt <u>any two</u> of the following : **[2 × 5 = 10]**

    i) Construct a Turing Machine recognising the language

        $L = \{a^n \, b^n \mid n \geq 1\}$.

    ii) Explain 'Chomsky Hierarchy'.

    iii) Explain an Universal Turing Machine.

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P1019

[3935]-401

M.Sc. Tech

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 401 : Topology
(New Course) (Sem. - IV) (2008 Pattern)

Time : 3 Hours]   *Max. Marks : 80*

Instructions to the candidates:
   1)   All questions are compulsory.
   2)   Figures to the right idicate full marks.

Q1)   Answer any eight of the following: **[16]**
   a)   Define : Topology and give an example of non metrizable topological space.
   b)   Define a hausdorff space with an example.
   c)   Are (0,1) and [0,1) homeomorphic? Justify.
   d)   State the Tychonoff's theorem.
   e)   Is arbitrary intersection of open sets open? Justify.
   f)   Write down a non constant convergent sequence in Z, the set of integers.
   g)   Find a function $f : R \rightarrow R$ that is continuous at precisely one point.
   h)   Find the closure and interior of $A \subseteq R$, where $A = (0,1) \cup (1,5) \cup [9,60]$.
   i)   Is (0,1) a connected subspace of R_l? Where R_l is set of reals with lower limit topology.
   j)   Does there exist a topology which is discrete as well as indiscrete? Justify.

Q2) a)   Answer any one of the following: **[6]**
   i)   Let Y be a subspace of a topological space X. and $A \subset Y$. Then prove that A is closed in Y if and only if it equals the intersection of a closed set of X with Y.
   ii)   In finite complement topology on R, to what point or points does the sequence $x_n = \dfrac{1}{n}$ converge? Justify.

   b)   Answer any two of the following: **[10]**
   i)   Show that a topological space X is hausdorff if and only if the diagonal $\Delta = \{x \times x \mid x \in X\}$ is closed in $X \times X$.
   ii)   Prove that the continuous image of a connected space is connected.
   iii)   Let $Y \subset X$; let X and Y be connected. Show that if A and B form a separation of X -Y, then $Y \cup A$ and $Y \cup B$ are connected.

Q3) a) Answer any one of the following: [6]
   i) State and prove the Intermediate value problem.
   ii) State and prove the tube lemma

b) Answer any two of the following: [10]
   i) Give an example of a connected space with uncountably many path components. Justify.
   ii) Show by an example that the intersection of two compact spaces need not be compact.
   iii) Prove that the one point compactification of R is S'.

Q4) a) Answer any one of the following: [6]
   i) Prove by an example that the product of Lindelöf spaces need not be Lindelöf .
   ii) Prove that every metrizable space is normal.

b) Answer any two of the following: [10]
   i) Is every regular and second countable space normal? Justify.
   ii) State and prove that the urysohn's lemma for metric spaces.
   iii) Prove that every compact metrizable space is second countable.

Q5) a) Answer any one of the following: [6]
   i) Prove that a space is locally connected if and only if for every open set U of X each component of U is open in X.
   ii) Prove that the topologies on R^n induced by the euclidean metric 'd' and the square metric 'ρ'are the same as the product topology on R^n.

b) Answer any two of the following: [10]
   i) Let {A_n} be a sequence of connected subspaces of X, such that $A_n \cap A_{n+1} \neq \phi$ for all n. Show that UA_n is connected.
   ii) Show that in the finite complement topology on R, every subspace is compact.
   iii) Find a metric space in which not every closed and bounded subspace is compact.

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P1020

[3935]-402

M.Sc.Tech.

COMPUTER SCIENCE

Industrial Mathematics with Computer Applications

MIM-402 : Computer Networks

(Sem . - IV) (New Course) (2008 Pattern)

Time : 3 Hours]   *[Max. Marks : 80*

Instructions to the candidates:

1) *All questions are compulsory.*
2) *All questions carry equal marks.*
3) *Figures to the right indicate full marks.*
4) *Neat diagrams must bedrawn wherever necessary.*

Q1) Attempt any eight of the following: **[8 X 2 = 16]**

a) Write a short note on interfaces between layers.

b) Define the following terms with suitable examples.

     i) Analog Signal.

     ii) Digital Signal.

c) What do you mean by line coding? Explain"Signal element versus data element" as characteristics of line coding.

d) Explain Single-bit error and burst error with suitable example.

e) Write a short note on remote bridges.

f) Explain any four characteristics of routing algorithms.

g) Explain the fields of UDP packet header.

h) Discuss the role of UA and MTA used in SMTP protocol.

i) Find the class of the following IP addresses:

     i) 114.34.12.8

     ii) 127.24.6.8

     iii) 242.34.54.15

     iv) 232.34.2.1

j) Discuss the role of checksum field used in TCP segment.

Q2) a) Attempt <u>any one</u> of the following: **[1 X 6 = 6]**

    i) What are the responsibilities of the transport layer in the Internet model?

    ii) Explain the three techniques of digital - to-digital encoding.

  b) Attempt <u>any two</u> of the following: **[2 X 5 = 10]**

    i) Write a note on microwaves. Also explain unidirectional antenna and horn antenna.

    ii) What do you mean by pipelining. Explain with suitable diagram: "Go Back n" protocol.

    iii) Write a note on store and forward packet switching.

Q3) a) Attempt <u>any one</u> of the following: **[1 X 6 = 6]**

    i) Write a note on parallel transmission and serial transmission. Also draw suitable diagram.

    ii) Briefly describe the services provided by the data link layer.

  b) Attempt <u>any two</u> of the following: **[2 X 5 = 10]**

    i) Write a note on TCP/ TP reference model.

    ii) What is the idea behind controlled access? Write a note on reservation protocol.

    iii) Explain : simplex stop - and - wait protocol.

Q4) a) Attempt <u>any one</u> of the following: **[1 X 6 = 6]**

    i) Give brief details of the components mention, Bridges, swithes, and repeaters.

    ii) How network layer impliments connectionless and connection oriented services?

  b) Attempt <u>any two</u> of the following: **[2 X 5 = 10]**

    i) What is framing? Explain any two methods of framing with their disadvantages.

    ii) Write a note on distance vector Routing.

    iii) Explain the working of TELNET protocol.

Q5) a) Attempt <u>any one</u> of the following: **[1 X 6 = 6]**

     i)   Explain the various tasks performed by physical layer.

     ii)   Write a note on remote procedure call.

  b) Attempt <u>any two</u> of the following: **[2 X 5 = 10]**

     i)   Explain any five fields of IPV_4 packet format.

     ii)   Write a short note on "Congestion Control".

     iii) Explain connection release in TCP protocol.

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P1021

[3935]-403

M.Sc Tech - II
COMPUTER SCIENCE
Industrial Mathematics with Computer Applications
MIM - 403 : Web Technology
(New Course)

Time : 3 Hours]   *Max. Marks : 80*

Instructions to the candidates:

1)   *All questions are compulsory.*

2)   *Figures to the right indicate full marks.*

Q1) Attempt <u>any eight</u> of the following: **[16]**

a) What is difference between shift, unshift and push pop methods in java script?

b) What is IP address? How IPV6 is different from IPV4?

c) List 2 different kinds of converters that can be used to create HTML documents.

d) What is purpose of qq operator in perl? Give suitable example for the same.

e) What is session tracking? Which object is used for session tracking in java?

f) What is query string?

g) Describe the meaning of the default attribute values # REQUIRED and # IMPLIED in DTD .

h) What is PHP processor? What are the 2 modes of the PHP processor?

i) What are comments? How comments are specified in HTML?

j) What are four scalar types of PHP?

Q2) Solve <u>any four</u> of the following: **[16]**

a) What is cookie? How CHI. Pm module support creation of cookies?

b) Explain any four string functions in PHP with suitable examples.

c) What advantages do servlet have over CGI programs?

d) What is XML schema? How it is advategeous over DTD?

e) Explain various predefined character classes in javascript.

Q3) Solve <u>any four</u> of the following: **[16]**

    a**)** Explain servlet lifecycle methods.

    b) Explain any four relational operators used in perl, with suitable example.

    c) Explain concept of pass by reference in PHP with example.

    d) Differentiate between XML and HML.

    e) Write short note on web browsers.

Q4) Attempt <u>any four</u> of the following.   **[16]**

    a) Write a perl program to count and display number of students who have scored > = 60 percent. (Assume that the input to the program is a file student. txt containing student data in following format -

        student name : age : class : percentage)

    b) Explain logical structure of arrays in PHP with suitable diagram.

    c) Explain any four methods of httpservlet class.

    d) Give example for creation of

        i)   Ordered list.

        ii) Definition list.

    e) "Java script is an object oriented programming language". State whether True / False and justify your answer.

Q5) Attempt <u>any four</u> of the following.   **[16]**

    a) Explain concept of hashes with suitable example.

    b) Write a PHP script to display message, "welcome to PHP" and the current day of the week, the month and day of month following it.

    c) Describe various purposes of XML processors.

    d) Explain HTTP protocol.

    e) What is an event and an event handler? List any 4 event attributes and their tags, that can be handled in javascript.

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P1022

[3935] - 404
M.Sc. Tech. (Sem. - IV)
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 404 : Design and Analysis of Algorithms
(New) (2008 Pattern)

Time : 3 Hours]   *[Max. Marks : 80*

Instructions to the candidates:

    1)   *All questions are compulsory.*

    2)   *Figures to right indicate full marks.*

Q1) Attempt <u>any eight</u> of the following :   **[8 × 2 = 16]**

    a)   Define θ and O notation.

    b)   Explain the term 'Recursion Tree'.

    c)   Explain the term 'Heap property.

    d)   Show that $5n^2 + 3n$ is $\theta(n^2)$.

    e)   Describe 'Matrix chain multiplication problem'.

    f)   Define NP Hard Problem.

    g)   State true or false. Justify "The code words of the two least frequent characters have the same length".

    h)   Define : Transitive closure of a graph.

    i)   What is best case and worst case time complexity for quick sort algorithm?

    j)   Explain divide and conquer strategy.

Q2) Attempt <u>any two</u> of the following :   **[2 × 8 = 16]**

    a)   Explain Heap sort. Explain the algorithm to construct heap from elements of given array & sorts it write Heapify algorithm.

    b)   Discuss Floyd-Warshall algorithm for all pairs shortest path for a given weighted directed graph G = (V, E) with *n* vertices.

    c)   What is vertex cover problem? Prove that the vertex-cover problem is NP-complete.

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Q3) Attempt <u>any two</u> of the following :   **[2 × 8 = 16]**

a) Calculate the maximum flow in the following network using ford Fulkerson algorithm.
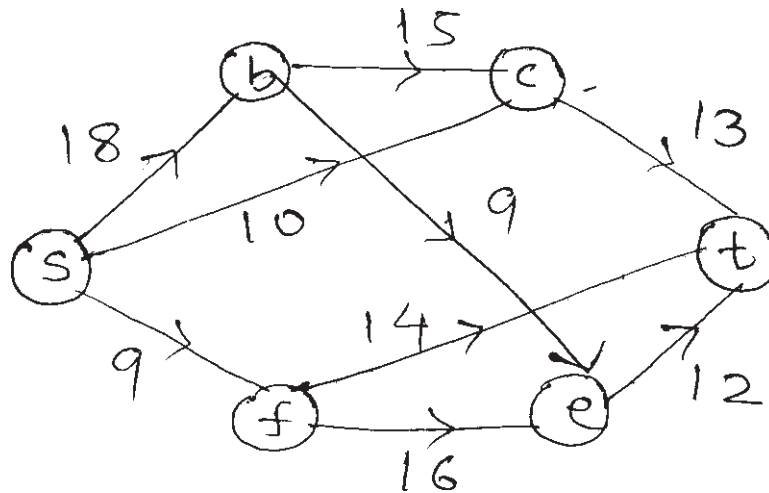
b) Given the string of four matrices M_1, M_2, M_3, M_4 where $r_0 = 10$, $r_1 = 20$, $r_2 = 50$, $r_3 = 1$, $r_4 = 100$. Find the minimum number of operations (scalar multiplications) required to evaluate the product assuming that matrix m_i has dimension $r_{i-1} \times r_i$.

c) Consider the travelling salesperson problem instance defined by following cost matrix. Find the tour of minimum cost

$$\begin{bmatrix} \infty & 7 & 3 & 12 & 8 \\ 3 & \infty & 6 & 14 & 9 \\ 5 & 8 & \infty & 6 & 18 \\ 9 & 3 & 5 & \infty & 11 \\ 18 & 14 & 9 & 8 & \infty \end{bmatrix}$$

Q4) Attempt <u>any four</u> of the following :   **[4 × 4 = 16]**

a) What is an optimal Huffman coding for the following set of frequencies based on the first 6 fibonacci numbers

       a:1 b:1 c:2 d:3 e:5 f:8

b) If $f_1 (n) \in O (g_1 (n))$ and $f_2 (n) \in O (g_2 (n))$. Prove that $f_1 (n) + f_2 (n) \in O (\max (g_1(n), g_2(n)))$.

c) Explain topological sort algorithm.

d) Write a note an NP-Completeness.

e) Rank the following functions in their increasing order of growth rates. The functions are e^n, n^n, $n!$, $\log_e n^n$, and n^2.

Q5) Attempt <u>any four</u> of the following :   **[4 × 4 = 16]**

   a)   Explain activity selection problem. Also Illustrate it using greedy strategy.

   b)   Merge sort the array a[1 : 10] = (310, 285, 179, 652, 351, 423, 861, 254, 450, 520).

   c)   Using prim's algorithm find minimum spanning tree for the following graph.
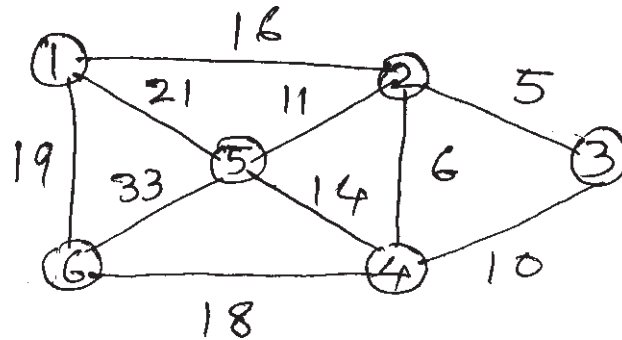
   d)   Explain Bellman Ford algorithm for solving single source shortest path problem.

   e)   Explain how dynamic programming is used to solve the longest common subsequence problem.

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P1023

[3935] - 501

M.Sc. (Tech.)

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 501 : Operations Research and Optimizing Techniques
(New) (2008 Pattern)

Time : 3 Hours]　　　　　　　　　　　　　　　　　*[Max. Marks : 80*
Instructions to the candidates:
　　1)　All questions are compulsory.
　　2)　Figures to the right indicate full marks.
　　3)　Use of single memory, non-programmable scientific calculator is allowed.
　　4)　Graph papers will be supplied on demand.

Q1) Attempt <u>each</u> of the following :　　　　　　　　**[2 Marks Each]**

　　a)　Explain concept of iteration while solving a linear Programming Problem.

　　b)　Convert the following unbalanced transportation model into a balanced transportation model.

	D_1	D_2	D_3	D_4	D_5	Supply
A	4	16	1	16	14	400
B	18	10	8	13	12	500
C	6	1	4	12	2	700
Demand	500	400	300	300	600	

　　c)　How degeneracy is located in a transportation model?

　　d)　Draw the feasible region of the following L.P.P.
　　　　$2x + 3y \geq 1$
　　　　$3x - 2y \geq 3$
　　　　$x, y \geq 0$

　　e)　In graphical method, the feasible region, if it exists, is always in the 1st quadrant, state whether the statement is true or false And justify your answer.

　　f)　Find all solutions of the following assignment problem :

　　　　　　　　Jobs

Machines	A	B
1	5	5
2	5	5

P.T.O.

g) Match the following :
    i)   Linear Programming   1) VAM
    ii) Transportation Problem   2) Saddle Point
    iii) Assignment Problem   3) Simplex Method
    iv) Game Theory   4) Hungerian Method

h) Consider the following game :

                        B
            3   6   1
        A   5   2   3
            4   2   5

    If ϑ is the value of the game, then justify the following statement.
        "$2 \leq \vartheta \leq 3$"

Q2) Attempt <u>any four</u> of the following :   **[4 Marks Each]**
    a) Discuss scope and limitations of Operation Research.
    b) Solve the following L.P.P. by graphical method :
        Minimize : $Z = 5x_1 + 2x_2$
        Subject to constraints :
            $3x_1 + x_2 \geq 3$
            $3x_1 - 2x_2 \leq 6$
            $x_1 + x_2 \leq 4$
            $x_1, x_2 \geq 0$
    c) Define each of the following term :
        i)   Artificial variable.
        ii) Objective function in L.P.P.
        iii) Feasible solution.
        iv) Slack variable.
    d) Convert the following L.P.P. in equivalent standard form :
        Maximize $Z = -2x_1 + 3x_2 + 4x_3$
        Subject to constraints :
            $x_1 + 3x_2 + 5x_3 \leq 10$
            $3x_1 - x_2 - 2x_3 \leq -4$
            $x_1 \leq 0, x_2, x_3 \geq 0$
    e) What is unbounded solution of L.P.P.? Discuss how unbounded solution is located while solving L.P.P. by graphical method?

f) A company sells two products A and B making a profit of Rs. 40 and Rs. 30 per unit respectively. The total capacity of the production process is 30,000 man-hours. It takes three hours to produce one unit of A and one hour to produce one unit of B. It has been founded that a maximum of 8000 units of A and 12000 units of B can be sold in the market. Formulate the linear programming problem so as to get maximum profit.

Q3) Attempt <u>any four</u> of the following : **[4 Marks Each]**

a) Explain concept of duality. Discuss it's economic interpretation with the help of an example.

b) Solve the following L.P.P. by simplex method carry out maximum two iterations.
Maximize : $Z = 2x_1 + 4x_2 + x_3$
Subject to : $x_1 + 3x_2 \leq 4$
$\qquad 2x_1 + x_2 \leq 3$
$\qquad x_2 + 4x_3 \leq 3$
$\qquad x_1, x_2, x_3 \geq 0$

c) Write the dual equivalent to the following L.P.P.
$\qquad$ Minimize : $Z = 4x_1 + 5x_2 - 3x_3$
$\qquad$ Subject to : $x_1 + x_2 + x_3 = 22$
$\qquad\qquad 3x_1 + 5x_2 - 2x_3 \leq 65$
$\qquad\qquad x_1 + 7x_2 + 4x_3 \geq 120$
$\qquad\qquad x_1, x_2, x_3 \geq 0.$

d) Comment upon the truthness of the following statement
"The dual of a dual is primal problem". Justify your answer.

e) Solve the following game by arithmetic method :

$$\begin{array}{cc} & \begin{array}{cc} B_1 & B_2 \end{array} \\ \begin{array}{c} A_1 \\ A_2 \end{array} & \begin{bmatrix} 50 & 10 \\ 30 & 40 \end{bmatrix} \end{array}$$

f) Define each of the following :
i) Saddle point.
ii) Pure strategy.
iii) Player in a game.
iv) Strategy of a player.

Q4) Attempt <u>any two</u> of the following : **[8 Marks Each]**

a) Find IBFS of following transportation model by least cost method. Test whether it is optimal or not. If not, improve upon the solution by carrying out one iteration by MODI method.

Market

Warehouse	M_1	M_2	M_3	M_4	a_i
W_1	8	10	7	6	50
W_2	12	9	4	7	40
W_3	9	11	10	8	30
b_j	25	32	40	23	120

b) i) A project consists of a series of jobs A, B, C, D, E, F, G, H, I such that, A < D, E; B, D < F; C < G; B < H; F, G < I

The time of completion of each job is as follows :

Job	A	B	C	D	E	F	G	H	I
Time (days)	23	8	20	16	24	18	19	4	10

Draw the network diagram for the above project.

ii) Explain how an assignment model is a special case of a transportation model.

c) Solve following travelling salesman problem as an assignment model.

Cities

Cities	A	B	C	D
A	∞	46	16	40
B	41	∞	50	40
C	42	32	∞	60
D	40	40	36	∞

d) i) Reduce the order of the following game by principle of dominance.

	B_1	B_2	B_3
A_1	1	7	2
A_2	0	2	7
A_3	5	1	6

ii) Solve the following game by graphical method

$$
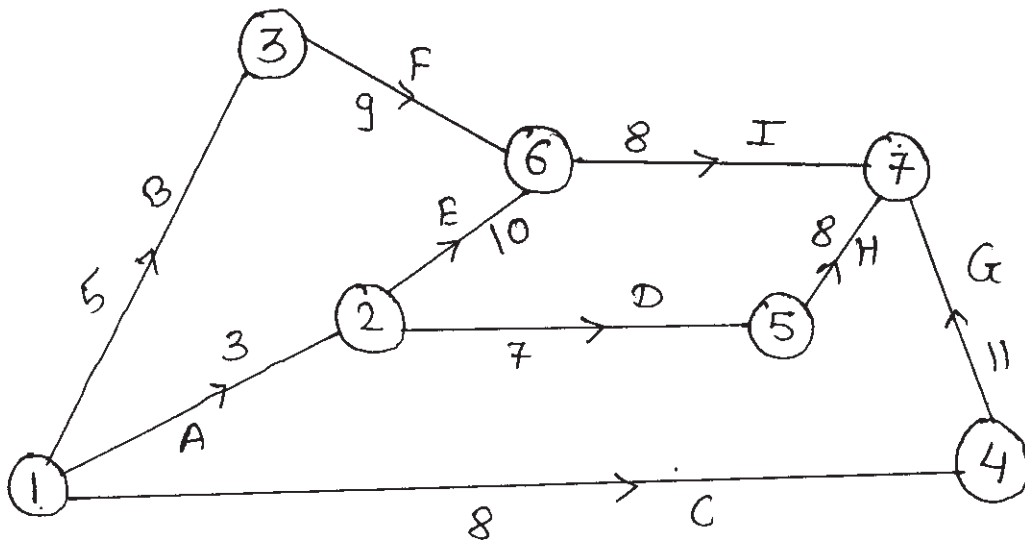A \begin{array}{c} \\ \\ \\ \end{array} \begin{bmatrix} 4 & -5 \\ -1 & -2 \\ 2 & 5 \end{bmatrix}
$$

B

Q5) Attempt <u>any two</u> of the following : **[8 Marks Each]**

a) A project is represented by the network given below and has the following data :

Task	A	B	C	D	E	F	G	H	I
optimistic time t_o	2	3	5	5	8	7	9	3	6
Most likely time t_m	3	5	8	7	10	9	11	8	8
Pessimistic time t_p	4	7	11	9	12	11	13	13	10

Determine the following :

i) Expected task times, t_e.

ii) Variance of the task, σ^2.

iii) Critical path.

b) i) Why VAM is said to be the best method to find IBFS of T.P?

ii) Obtain the optimal solution of the following transportation problem by MODI method.

	D_1	D_2	D_3	D_4	Capacity
S_1	10	0	20	11	15
S_2	1	7	9	20	25
S_3	12	14	16	9	5
Demand	12	8	15	10	

c) i) Define balanced assignment problem.

ii) The expected sales by 4 salesmen in each of the four zones are given below :

	1	2	3	4
A	42	35	28	21
B	30	25	20	15
C	30	25	20	15
D	24	20	16	12

Determine the optimal assignment so as to maximize the sales.

d) Solve the following L.P.P. by simplex method.

Minimize $Z = 3x_1 + x_2$

Subject to : $5x_1 + 2x_2 \geq 10$

$x_1 + x_2 \geq 6$

$x_1 + 4x_2 \geq 12$

$x_1, x_2 \geq 0$

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[3935] - 502
M.Sc. Tech. (Sem. - V)
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 502 : Numerical and Statistical Methods
(New Course)

Time : 3 Hours]   *[Max. Marks : 80*

Instructions to the candidates:

1) Figures to the right indicate full marks.

2) All questions are compulsory.

3) Use of non-programmable scientific calculator is allowed.

Q1) Attempt <u>any eight</u> of the following :   **[8 × 2 = 16]**

a) Six married couples are standing in a room. Two people are chosen at random. Find the probability that they are married.

b) Let P be a probability measure defined on $S = \{a_1, a_2, a_3\}$. Find $P(a_1)$ if $P(a_3) = 2P(a_2)$ and $P(a_2) = 3P(a_1)$.

c) If A is an event defined on Ω, show that A and Ω are independent.

d) Let X be a binomially distributed random variable with $E(X) = 2$ and $Var(X) = 4/3$. Find the parameters n and p.

e) Let Z be a standard normal variable. Find $P(Z \leq -0.22)$ and $P(Z \geq 0.44)$.

f) Let X be a discrete random variable having poisson distribution with parameter λ. State the p.m.f. of X. Also state its mean and variance.

g) Define product moment correlation co-efficient. Interpret the result $r = -1$ and $r = +1$

h) Write the equations of two lines of regression. State the point of intersection of these lines.

i) Define multiple correlation co-efficient and partial correlation coefficient.

j) Define the terms 'Test statistic' and 'critical region'.

Q2) Attempt <u>any four</u> of the following : **[4 × 4 = 16]**

    a)   A card is selected at random from an ordinary pack of 52 playing cards. Consider the following events :

        A = {heart} and B = {face card}.

        Find P(A), P(B), P(A ∩ B), P(A ∪ B).

    b)   Let A and B be events with P(A) = 1/3, P(B) = 1/4 and P(A ∪ B) = 1/2. Find P(A|B), P(B|A).

        Are A and B independent.

    c)   When are two events A and B defined on Ω said to be independent? Can they be independent and mutually exclusive simultaneously? Justify your answer.

    d)   Define distribution function of a continuous random variable X. State its properties.

    e)   Find density function $f(x)$ of a continuous random variable X whose CDF is as follows :

$$F(x) = \begin{cases} 0 & if \ x < 0 \\ x^5 & if \ 0 \le x \le 1 \\ 1 & if \ x > 1 \end{cases}$$

        Hence or otherwise find P(1/2 < X < 2/3).

Q3) Attempt <u>any four</u> of the following : **[4 × 4 = 16]**

    a)   A random variable X takes values −3, −1, 2 and 5 with probabilities $\frac{2k-3}{10}, \frac{k-2}{10}, \frac{k-1}{10}, \frac{k+1}{10}$ respectively. Determine the value of k. Hence find E(X).

    b)   Let X be a continuous random variable with density function given by,

$$f(x) = \frac{1}{2}x, \quad 0 \le x \le 2$$
$$= 0 \quad , \quad 0.W.$$

        Find mean, variance and distribution function of X.

    c)   Write the p.m.f. of Binomial distribution with parameters n and p. State its mean and variance. Also mention one real life situation where Binomial distribution is applicable.

d) Suppose 300 misprints are distributed randomly throughout a book of 500 pages. Using poisson distribution, find the probability that a given page contains,

 i) exactly 2 misprints.

 ii) 2 or more misprints.

e) Let X be a continuous random variable with uniform distribution over (2, 10). Find mean and variance of X.

Q4) Attempt <u>any four</u> of the following : **[4 × 4 = 16]**

a) Suppose that the student IQ scores form a normal distribution with mean $\mu = 100$ and standard deviation $\sigma = 20$. Find the percentage of students whose scores fall between

 i) 80 and 120

 ii) Over 160.

b) Suppose the lifetime X in days of a certain component is exponential with $\theta = 120$. Find the probability that the component will last

 i) less than 60 days.

 ii) more than 240 days.

c) Let a continuous random variable X follows normal distribution with parameters μ and σ^2. Write pdf of X. State additive property of normal distribution. Also state the distribution of $y = \dfrac{X - \mu}{\sigma}$.

d) Explain in brief the method of least squares to obtain the regression line of Y on X.

e) The two lines of regression are given by,

$x + 2y - 5 = 0$

and $2x + 3y - 8 = 0$.

If $\sigma_x^2 = 12$, calculate $\overline{X}, \overline{Y}, \sigma_y^2$ and γ_{xy}.

Q5) Attempt <u>any four</u> of the following : **[4 × 4 = 16]**

a) Explain the test procedure for testing $H_0 : P = P_0$ against $H_1 : P \neq P_0$ for a large sample at 5% level of significance.

b) A company introduces a new product in 4 locations A, B, C and D. The number of items sold during a weekend are as follows :

Location	A	B	C	D
No. of items sold	80	65	70	85

Test the hypothesis that the location doesnot make a difference on sales at 5% l.o.s.

c) Define the following terms :
  i)   Null hypothesis   ii)   Alternative hypothesis
  iii) One tailed test   iv)   Two tailed test.

d) From the heights X_1, weights X_2 and ages X_3 of a group of students the following data was obtained :

$\sigma_1 = 2.81$ $\sigma_2 = 12$ $\sigma_3 = 1.5$

$\gamma_{12} = 0.75$ $\gamma_{23} = 0.54$ $\gamma_{13} = 0.43$

Calculate $b_{12.3}$, $\gamma_{23.1}$ and $R_{2.13}$.

e) Find missing values in the following ANOVA table :

Source	df	Sum of squares	Mean sum of squares	F-value
Treatment	–	–	–	–
Error	16	82.3	5.14	
Total	19	179.8		

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P1025
[3935]-503
M.Sc.Tech.
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM-503 : Digital Image Processing
(New Course) (2008 Pattern)

Time : 3 Hours]   *[Max. Marks : 80*
Instructions to the candidates:
    1)   All questions are compulsory.
    2)   Figures to the right indicate full marks.
    3)   use of log table / calculator is allowed.

Q1) Attempt any eight of the following   **[8 X 2 = 16]**

    a)   State any two sources of noise.

    b)   What is image histogram?

    c)   Define the terms mean and standard deviation.

    d)   What is texture?

    e)   What is JPEG and TIFF?

    f)   What is a digital image?

    g)   Define the terms luminance and radiance.

    h)   What is pseudocolour image processing?

    i)   State the use of thresholding in segmentation.

    j)   What is image restoration?

Q2) Answer any four of the following.   **[4 X 4 = 16]**

    a)   Explain with suitable example the negative image enhancement.

    b)   Explain the global thresholding algorithm.

    c)   Explain with suitable example the difference between correlation and convolution.

    d)   Discuss with necessary diagram the histogram equalisation.

    e)   Discuss the method of brightness and contrast control state the advantage of gamma correction.

Q3) Attempt any four of the following: **[4 X 4 = 16]**

a) Explain with suitable diagram any one type of image acquisition device

b) Define the terms spatial resolution and intensity level resolution.

c) Explain sampling and quantization of digital image.

d) Discuss the RGB model for colour image.

e) Explain the HIS model and give the conversion of RGB to HIS.

Q4) Answer any four of the following **[4 X 4 = 16]**

a) Discuss the image sharpening in the frequency domain.

b) Explain the use of low pass filter for smooting of digital image.

c) Discuss the methods of noise removal from the image data.

d) Explain the use of image processing in fingerprint identification.

e) Discuss the role of image processing in medical applications.

Q5) Answer any two of the following. **[2 X 8 = 16]**

a) Discuss the discrete Fourier transform. Explain its use in image processing.

b) With the help of suitable masks explain the following.

    i) Point detection.

    ii) Line detection.

    iii) Edge detection.

c) With the help of neat diagram. Illustrate and explain various steps in image processing.

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P1026

[3935] - 504

M.Sc. (Tech.)

COMPUTER SCIENCE

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 504: Advanced Operating System

(Sem. - V) (New Course) (2008 Pattern)

Time : 3 Hours]   *[Max. Marks : 80*

Instructions to the candidates:

1) *All questions are compulsory.*
2) *All questions carry equal marks.*
3) *Neat diagrams must be drawn wherever necessary.*

Q1) Attempt <u>any eight</u> of the following: **[8 X 2 = 16]**

   a)   "Kernel said to be non-preemptive" - Comment.

   b)   Define - buffer cache.

   c)   Explain any two options of "rpm" - package installation command.

   d)   Define - pregion . Also state existence of pregion.

   e)   Explain the role of setpgrp system call.

   f)   Define - U Area.

   g)   What is nice value?

   h)   Explain the need of swapping.

   i)   Discuss the role of device drivers.

   j)   Explain all the parameters of msgsnd system call.

Q2) a)   Attempt <u>any one</u> of the following: **[1 X 6 = 6]**

      i)   Explain in detail about process creation.

      ii)   Explain in detail about process states and transitions.

   b)   Attempt <u>any two</u> of the following: **[2 X 5 = 10]**

      i)   What are the different states in which a page can reside if it caused the fault?

      ii)   List out the five scenarios the Kernel may follow in getblk to allocate a buffer for a disk block.

      iii)   What is file system? Explain the terms: boot block, super block, inode list, data blocks.

Q3) a) Attempt <u>any one</u> of the following: **[1 X 6 = 6]**

    i) Explain the three cases that Kernel follows when freeing resources.

    ii) Explain the manipulation of the process address space.

b) Attempt <u>any two</u> of the following: **[2 X 5 = 10]**

    i) Explain in detail about process termination.

    ii) Write a note on ioctl system call.

    iii) With suitable diagram, explain the acceptance of a call from the server.

Q4) a) Attempt <u>any one</u> of the following: **[1 X 6 = 6]**

    i) Explain the syntax of kill system call. Also state the significance of the following terms:

        1) Pid is a positive integer.

        2) Pid is Zero.

        3) Pid is -1

        4) Pid is a negative integer but not - 1

    ii) Write a note on expansion swap?

b) Attempt <u>any two</u> of the following: **[2 X 5 = 10]**

    i) Discuss the algorithm for handling interrupts.

    ii) Write down a source code for a program that catches signals.

    iii) Write a note on "ntsysv" - a service management tool.

Q5) a) Attempt <u>any one</u> of the following: **[1 X 6 = 6]**

    i) Which command is used to set the sticky-bit file mode? Discuss the various cases under which Kernel removes the entries for sticky-bit text regions.

    ii) What is the use of messages? In addition to the general IPC permissions field, which are the additional fields of message queue structure?

b) Attempt <u>any two</u> of the following: **[2 X 5 = 10]**

    i) State any five fields of the u area.

    ii) Write a short note on fork swap.

    iii) State the advantages and disadvantages of buffer cache.

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P1027

[3935] - 44
M.Sc. (Tech.)
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 404 : Operating Systems - II
(Sem. - IV) (Old Course) (2005 Pattern)

Time : 3 Hours]   *[Max. Marks : 80*
Instructions to the candidates:
    1)   *All questions are compulsory.*
    2)   *Figures to the right indicate full marks.*

Q1) Attempt <u>any eight</u> of the following: **[8 X 2 = 16]**
    a)   What do you mean by "working set of process"?
    b)   Give usage of following commands.
        i)   *ls - a*
        ii)   *ls - l*
    c)   What are the two modes in which the line discipline operates?
    d)   State the two types of page faults the system can incur.
    e)   Explain following shell commands.
        i)   cat
        ii)   wc
    f)   Define inode.
    g)   What is shell? Which is a default shell of UNIX operating system?
    h)   Give syntax and use of fsck ( ).
    i)   Give difference between -eq and -z operators.
    j)   What is real and effective user ID?

Q2) Attempt <u>any four</u> of the following: **[4 X 4 = 16]**
    a)   Explain working of dup ( ) system call, with an example.
    b)   What is distributed system? Give advantages of distributed system.
    c)   Explain following UNIX commands.
        i)   grep.
        ii)   diff.
    d)   Write shell script for addition of first n numbers.
    e)   Explain working of link ( ) system call.

Q3) Attempt <u>any four</u> of the following: [4 X 4 = 16]
   a)   Differentiate between named pipe and unnamed pipe.
   b)   Write a shell script for reversing a given number.
   c)   Write a short note on 'page stealer process'.
   d)   Describe "fork swap".
   e)   Explain the concept of generic inode.

Q4) Attempt <u>any four</u> of the following: [4 X 4 = 16]
   a)   Explain various scenarios of getblk algorithm.
   b)   Explain working of namei ( ) algorithm.
   c)   How does Kernel maintains free space for the swap device?
   d)   What are directories? What read, write, execute permissions mean for a directory?
   e)   Explain how system calls are classified?

Q5) Attempt <u>any four</u> of the following: [4 X 4 = 16]
   a)   What is a C-list? Describe various operations that can be performed on C-list.
   b)   A process wants to access byte offset 9000 in a file. Find the block number and byte offset in that block in a file system with 1k bytes per block.
   c)   Describe characteristics of UNIX file system.
   d)   Write a shell script for displaying factorial of a given number.
   e)   Write short note on disk inode?

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Q3) Attempt any four of the following: [4 × 4 = 16]

   a) Write steps for deriving test cases.

   b) What is integration testing?

   c) What is meant by sampling distribution.

   d) Explain regression testing with eg.

   e) State the requirements of ISO 9001 standard.

Q4) Attempt any four of the following: [4 × 4 = 16]

   a) What is six - sigma quality? Explain in detail.

   b) Differentiate between validation & verification in SQA

   c) Explain Testing process in detail.

   d) What are the advantages of cause - and - effect diagram.

   e) explain statement coverage eritesion in white box testing.

Q5) Attempt any four of the following: [4 × 4 = 16]

   Write a short note on

   a) SQA plan.

   b) Testing for real tince system.

   c) Function oriented metrices.

   d) Quality movement.

   e) Junit & Loadrunner.

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P1026

[3935]-504

M.Sc.Tech.

COMPUTER SCIENCE

Industrial Mathematics with Computer Applications

MIM-504 : Advanced Operating System

(Sem.-V) (New Course)

Time : 3 Hours] *[Max. Marks : 80*

Instructions to the candidates:

1) *All questions are compulsory.*

2) *All questions carry equal marks.*

3) *Neat diagrams must be drawn wherever necessary.*

Q1) Attempt any eight of the following: **[8 X 2 = 16]**

a) "Kernel said to be non-preemptive". Comment.

b) Define buffer cache.

c) Explain any two options of "rpm". Package Installation command.

d) Define-pregion. Also state existance of pregion.

e) Explain the role of setpgrp system call.

f) Define-U Area.

g) What is nice value?

h) Explain the need of Swapping.

i) Discuss the role of device drivers.

j) Explain all the parameters of msgsnd system call.

Q2) a) Attempt any one of the following: **[1 X 6 = 6]**

i) Explain in detail about process creation.

ii) Explain in detail about process states and transitions.

b) Attempt any two of the following: **[2 X 5 = 10]**

i) What are the different states in which a page can reside it it caused the fault?

ii) List out the five scenarios the kernel may follow in get blk to allocate a buffer for a disk block.

iii) What is file system? Explain the terms: boot block. Super block, inode list, data blocks.

Q3) a) Attempt <u>any one</u> of the following: **[1 X 6 = 6]**

i) Explain the three cases that kernel follows when freeing resources.

ii) Explain the Manipulation of the process address space.

b) Attempt <u>any two</u> of the following: **[1 X 6 = 6]**

i) Explain in detail about process termination.

ii) Write a note on ioctl system call.

iii) With suitable diagram, explain the acceptance of a call from the server.

Q4) a) Attempt <u>any one</u> of the following: **[1 X 6 = 6]**

i) Explain the syntax of kill system call. Also state the significance of the following terms:

1) pid is a positive integer.

2) Pid is Zero.

3) Pid is -1

4) Pid is a negative integer but not -1

ii) Write a note on expansion swap?

b) Attempt <u>any two</u> of the following: **[2 X 5 = 10]**

i) Discuss the algorithm for handling interrupts.

ii) Write down a source code for a program that catches signals.

iii) Write a note on "ntsysv-a service management tool.

Q5) a) Attempt <u>any one</u> of the following: **[1 X 6 = 6]**

    i) Which command is used to set the stick-bit file mode? Discuss the various eases which kernel removes the entries for sticky- bit text regions.

    ii) What is the use of messages ? In addition to the general IPC permissions field which are the additional fields of message queue structure?

b) Attempt <u>any two</u> of the following: **[2 X 5 = 10]**

    i) State any five fields of the u area.

    ii) Write a short note on fork swap.

    iii) State the advantages and disadvantages of buffer cache.

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P1046

[3927]-405
M.Sc.
BOTANY
BO-4.43 : Angiosperms Special Paper - II
(2008 Pattern) (New) (Sem.-IV)

Time : 3 Hours]   *[Max. Marks : 80*
Instructions to the candidates:
  1)   *Attempt a total of five questions from the following, selecting at least two questions from each section.*
  2)   *Answer to the questions from each section should be written in spearate answer books.*
  3)   *Figures to the right indicate full merks.*
  4)   *Neat labeled diagrams must be drawn wherver necessary.*

Section - I

Q1) What is arboriculture? Mention various methods of arboticulture and explain post plantation care of trees.

Q2) a)   What is comatic tmbryogenesis? Explain any one application.

   b)   Enlist major India timber trees. Describe uses of any three trees.

Q3) Enlist the elements of wood. Explain their stru

Q4) Attempt <u>any two</u> of the following: **[16]**

   a)   Consider the casestudy and draw the data flow diagram with assumptions.

   A car insurance company wants to automate system. The system includes database of the customers i.e, car owners, accidents and drivers involved in accidents. The system also maintains information about injured drivers and passengers. The company provides information to the agencies wherever required.When a car is sold the information regarding the same enters in the database and various reports are generated. The company also includes reminders to be send to the customers regarding premium.

   b)   Explain Aggregation and composition with an example.

   c)   Draw the state diagram for a telephone answering machine that records incoming messages and displays the number of accepted messages on an LED display. The system should allow the telephone owner to dial in, type a sequence of numbers and have the recorded messages replayed over the phone.

                                                                   P.T.O.

Q5) Attempt <u>any four</u> of the following: **[16]**

a) Differentiate between Reverse engineering and Re-engineering.
b) Explain Validation testing.
c) Write a note on: Effective Modularity in System Design.
d) Write a note on : Object Model
e) Explain the difference between waterfall Model and Prototyping Model.

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P996

[3935] - 41

M.Sc. Tech. (Sem. - IV)

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 401 : Functional Analysis
(Old) (2005 Pattern)

Time : 3 Hours]   *[Max. Marks : 80*

Instructions to the candidates:
   1) *All questions are compulsory.*
   2) *Figures to the right indicate full marks.*

Q1) Answer <u>any eight</u> of the following :   **[16]**

   a)   Is it true that an infinite dimensional subspace of a normed linear space be closed? Justify.

   b)   Prove that every linear map from finite dimensional normed linear space to any normed linear space are continuous.

   c)   Let X be a normed linear space over K (K = R or C) and let $a(\neq 0) \in$ X. Show that there exists $f \in$ X' such that $f(a) = \| a \|$ and $\| f \| = 1$.

   d)   Let X and Y be normed linear spaces and Z is a closed subspace of X, prove that the quotient map Q from X to X/Z is continuous.

   e)   Let X be a normed space and A$\in$ BL(X). Prove that A is invertible iff A is bounded below and surjective.

   f)   Let X be an inner product space. For all $x, y \in$ X, prose that
        $$\| x + y \|^2 + \| x - y \|^2 = 2 (\| x \|^2 + \| y \|^2)$$

   g)   With suitable example show that the Riesz representation theorem do not hold for an incomplete inner product space.

   h)   Let H be a Hilbert space. For A, B $\in$ BL(H), show that $(A + B)^* = A^* + B^*$.

   i)   Let H be a Hilbert space. Prove that AB is normal if A commutes with B* and B commutes with A*.

   j)   Let X be a normed linear space. If E_1 is open in X and $E_2 \leq$ X then show that $E_1 + E_2$ is open in X.

Q2) a) Attempt <u>any one</u> of the following : [6]

    i)   Let X and Y be normed linear spaces and $F : X \to Y$ be a linear map such that the range $R(F)$ of F is finite dimensional. Prove that F is continuous iff the zero space $Z(F)$ of F is closed in X.

    ii)   Let $\{x_1, x_2, ...\}$ be a linearly independent subset of an inner product space X. Define $y_1 = x_1$, $u_1 = \dfrac{y_1}{\| y_1 \|}$ and for $n = 2, 3, ...$

$$y_n = x_n - \langle x_n, u_1 \rangle u_1 - .... - < x_n, u_{n-1} > u_{n-1}, \ u_n = \dfrac{y_n}{\| y_n \|} \text{ then prove}$$

    that $\{u_1, u_2, ---u_n\}$ is an orthonormal set in X.

  b) Answer <u>any two</u> of the following : [10]

    i)   Let X be a normed space over K and E_1, E_2 be nonempty disjoint convex subsets of X, where E_1 is open in X. Prove that there is a real hyperplane in X which separates E_1 and E_2 in the following sense: For some $f \in X'$ and $E \in R$, we have Re $(f(x_1)) < t \le$ Re $(f(x_2))$ for all $x_1 \in E_1$ and $x_2 \in E_2$.

    ii)   Let X be a Hilbert space and $\sum_n |k_n|^2 < \infty$, where $k_n \in /K$, prove that $\sum_n k_n u_n$ converges in X, where $\{u_1, u_2, u_n,....\}$ be a countable orthonormal set in X.

    iii) Let X and Y be normed linear spaces and $X \ne \{0\}$. Prove that $BL(X, Y)$ is a Banach space in the operator norm iff Y is a Banach space.

Q3) a) Answer <u>any one</u> of the following : [6]

    i)   Let H be a Hilbert space and $f \in H'$. Prove that there is a unique $y \in H$ such that $f(x) = < x, y >$, $x \in H$.

    ii)   Let X be a normed space and Y be a Banach space. Let X_0 be a dense subspace of X and $F_0 \in BL(X_0, Y)$. Prove that there is a unique $F \in BL(X, Y)$ such that $F/X_0 = F_0$. and $\| F \| = \| F_0 \|$.

b) Answer <u>any two</u> of the following : **[10]**

   i) Let H be a Hilbert space. For $f \in$ H', Let y_f be the representer of f in H. Prove that the map T : H' $\rightarrow$ H given by T(f) = y_f is a surjective conjugate-linear isometry.

   ii) Prove that a Banach space cannot have a denumerable basis.

   iii) Let H be a Hilbert space and A $\in$ B L (H). Prove that there is unique B $\in$ B L (H) such that for all

     $x, y \in$ H, < A (x), y > = < x, B(y) >.

Q4) a) Answer <u>any one</u> of the following : **[6]**

   i) Let X be a Banach space and Y be a normed space and {F_n} be a sequence in BL(X, Y) such that the sequence { $F_n(x)$} converges in Y for every $x \in$ X. For $n \in$ X, Define F(x) = $\lim\limits_{n \to \infty}$ $F_n(x)$.

     Prove that F is bounded linear map from X to Y and

     $\| F \| \leq \lim\limits_{n \to \infty} \inf \| F_n \| \leq \sup \{ \| F_n \| : n = 1, 2, ...\} < \infty$.

   ii) Is it true that every normal operator a unitary or self adjoint? Justify.

b) Answer <u>any two</u> of the following : **[10]**

   i) Let X and Y be normed linear spaces and F : X $\rightarrow$ Y be linear. Prove that F is an open map iff there exists some $\gamma > 0$ such that

     for every $y \in$ Y, there is some $x \in$ X with F(x) = $y \oint \| x \| \leq \gamma \| y \|$.

   ii) Let K = C and A $\in$ BL(H). Prove that there are unique self-adjoint operators B and C on H such that A = B + iC.

   iii) Let {u_α} be an orthonormal set in an inner product space X and $x \in$ X.
     Let E_x = {u_α | < x_1 y_α > $\neq$ 0} prove that E_x is a countable set.

Q5) a) Answer <u>any one</u> of the following : **[6]**

   i) Let X and Y be Banach spaces and F : X $\rightarrow$ Y be a linear map which is closed and surjective. Prove that F is continuous and open.

   ii) Let {$u_1, u_2, ...$} be a countable orthonormal set in an inner product space X and $x \in$ X. Prove that $\sum\limits_n |< x, u_n >|^2 \leq \| x \|^2$ where equality

     holds iff $x = \sum\limits_n \langle x, u_n \rangle u_n$.

b) Answer <u>any two</u> of the following : [10]

   i) Let X and Y be Banach spaces and let $F \in BL(X, Y)$ be bijective prove that $F^{-1} \in BL(X, Y)$.

   ii) Let X be an inner product space. Let E be an orthogonal set in X and OE. Prove that E is linearly independent.

   iii) Let X and Y be normed linear spaces and $F : X \rightarrow Y$ be linear map. Prove that F is a compact map iff for every bounded sequence $\{u_n\}$ in X, $\{F(u_n)\}$ has a subsequence which converges in Y.

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P997

[3935] - 42

M.Sc. Tech (Sem. - IV)

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 402 : Operations Research - II

(Old) (2005 Pattern)

Time : 3 Hours] *[Max. Marks : 80*

Instructions to the candidates:

    1)   *All questions are compulsory.*

    2)   *Figures to the right indicate full marks.*

Q1) Attempt <u>any eight</u> of the following : **[16]**

    a)   Find the feasible space of the constraint

        $3x_1 - x_2 \leq -3,\ x_1 \geq 0,\ x_2 \geq 0$

    b)   Explain the term 'artificial variable' and it's use in linear programming problem.

    c)   Write the dual of the following problem and find the optimal value of z. (Do not solve the dual by simplex)

               min z = $10\ x_1 + 4x_2 + 5x_3$

               s.t. $5x_1 + 7x_2 + 3x_3 \geq 50$

                        $x_1,\ x_2,\ x_3 \geq 0$

    d)   Explain the term 'shadow prices'.

    e)   Solve the game   Player B

        Player A $\begin{bmatrix} 6 & 2 \\ 4 & 6 \end{bmatrix}$

    f)   What is dynamic programming?

    g)   Determine the range for the value of game (V) for the game

               Player B

$$\begin{array}{cc} & \begin{array}{ccc} \text{I} & \text{II} & \text{III} \end{array} \\ \begin{array}{c} \text{I} \\ \text{Player A } \text{II} \\ \text{III} \end{array} & \begin{bmatrix} 0 & 1 & 2 \\ 2 & 0 & 1 \\ 1 & 2 & 0 \end{bmatrix} \end{array}$$

h) What is an unbalanced assignment problem? How do we solve it?

i) Solve the following assignment problem

	I	II	III	IV
A	2	10	9	7
B	15	4	14	8
C	13	14	16	11
D	4	15	04	9

j) Explain Fulkerson's rule for numbering events in network.

Q2) Attempt <u>any two</u> of the following : **[16]**

a) Reddy Mikks produces both interior and exterior paints from two raw materials M_1 and M_2. The following table provides the basic data of the problem.

	Tons of raw material Per ton of		maximum daily availability (tons)
	Exterior Paint	Interior paint	
Raw material M_1	6	4	24
Raw material M_2	1	2	6
Profit per ton ($ 1000)	5	4	

The market survey indicates that the daily demand for interior paint can not exceed that of exterior paint by more than 1 ton. Also the maximum daily demand of interior paint is 2 tons.

Reddy Mikks wants to determine the optimum (best) product mix of interior and exterior paints that maximizes the total daily profit. Formulate the problem & solve it by graphical method

b) Solve the following LPP using simplex method.

Min z = $4x_1 + x_2$

subject to , $3x_1 + x_2 = 3$

$4x_1 + 3x_2 \geq 6$

$x_1 + 2x_2 \leq 4$

$x_1, x_2 \geq 0$

c) The following is an IBFS of a transportation problem. Check whether it is optimal, if not find optimal solution

→ Destinations ↓ Origins	D_1		D_2		D_3		D_4		Supply
O_1	7	10	8	0		20		11	15
O_2	5	1		7	15	9	5	20	25
O_3		12		14		16	5	18	
Demand									

Q3) Attempt <u>any two</u> of the following :   **[16]**

a) Solve the dual of the following LPP using simplex method.

Minimize z = $x_1 + x_2$

S.t. $0.12\ x_1 + 0.04x_2 \geq 600$

$0.10x_1 + 0.40\ x_2 \geq 1000$

$x_1, x_2 \geq 0$

Hence find the solution of the dual and Primal.

b) Solve the following game using graphical method.

Player B

$$\text{Player A} \begin{bmatrix} 1 & 2 \\ 5 & 4 \\ -7 & 9 \\ -4 & -3 \\ 2 & 1 \end{bmatrix}$$

c) i) Explain 1) Degeneracy in transportation.

2) Maxmin and Minmax Criteria in game.

ii) Explain 'Sensitivity Analysis'.

Q4) Attempt <u>any two</u> of the following :   **[16]**

a) Solve the following LPP using Dual Simplex Method.

Minimize z = $3x_1 + 2x_2$

Subject to $3x_1 + x_2 \geq 3$

$4x_1 + 3x_2 \geq 6$

$x_1 + x_2 \leq 3$

$x_1, x_2 \geq 0$

b) The following table gives the activities in a construction project and other relevant information.

Activity :   1-2   1-3   2-3   2-4   3-4   4-5

Duration :   20   25   10   12   6   10

i) Draw the network for the project.

ii) Find Critical path.

iii) Find free, total and independent floats for each activity.

c) Express the following game as LPP (from B's point of view) and solve it by using simplex method.

Player B

$$\begin{array}{c} & I \quad II \quad III \\ \text{Player A} \begin{array}{c} I \\ II \\ III \end{array} \begin{bmatrix} 1 & 3 & 1 \\ 0 & 1 & 2 \\ 3 & 2 & 1 \end{bmatrix} \end{array}$$

Q5) Attempt any two of the following :   [16]

a) A company is faced with the problem of assigning 4 machines to 6 different jobs. The profits are estimated as below

Machine

		A	B	C	D
	I	3	6	2	6
	II	7	1	4	4
Job	III	3	8	5	8
	IV	6	4	3	7
	V	5	2	4	3
	VI	3	7	8	4

Solve the problem to maximize the total profit

b) i) Explain the concept of parametric programming.

ii) Explain the earliest and latest start time of an activity.

c) Consider the following transportation problem

	D_1	D_2	D_3	D_4	Supply
O_1	15	51	42	33	23
O_2	30	42	26	81	44
O_3	90	40	66	60	33
Demand	23	31	16	30	

Find IBFS using   1)   VAM
                  2)   North-west corner method

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P998

[3935]-43

M.Sc Tech

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 403 : Object Oriented Programming with Java
(Sem. - IV) (Old)

Time : 3 Hours]   *Max. Marks : 80*

Instructions to the candidates:

1)   All questions are compulsory.

2)   Figures to the right idicate full marks.

Q1) Attempt <u>any eight</u> of the following: **[16]**

    a**)** What is 'javac' tool? Explain its use.

    b) How constants are defined in java?

    c) What is an exception? List and briefly explain different types of exception.

    d) What is the purpose of keyword 'new'? Explain what happens when it is used?

    e) Explain the difference between local variable and instance variable.

    f) What is the difference between preincrementing and postincrementing a variable? Give suitable example.

    g) What is the use of access specifier 'protected'?

    h) Explain if - else statement with suitable example.

    i) Explain how 1- dimensional and 2- dimensional arrays are declared.

    j) What is a constructor? Explain with example.

Q2) Attempt <u>any four</u> of the following: **[16]**

    a) What are different types of JDBC drivers? Explain with suitable example.

    b) Explain thread lifecycle. Draw suitable dig. and give suitable example.

    c) What is object serialization? Explain the process of serialization.

    d) What is layout manager? Explain any 2 layout managers with proper syntax and example.

    e) What are servlets? Explain advantages of servlet over traditional CGI.

Q3) Attempt <u>any two</u> of the following: **[16]**

    a**)** Define a class vehicle having methods to accept parameters like : type of vehicle, company - name and seating capacity. Derive two classes : light vehicle and heavy vehicle. Define one more class to use these classes and show the information with appropriate data.

    b) Write a program to accept 'n' numbers from the user. find out odd and even numbers from given 'n' numbers. Accept input through command line argument.

c) Write a program to create an applet with a Text Box and command button. Accept time from the user. According to time, display 'Goodmorning / Goodevening in the same text box on the click of command button.

Q4) Attempt <u>any two</u> of the following: **[16]**

a) Write a program to define a class account with the fields : acc - no, acc - type & balance. Accept details of 5 different accounts and find out the highest balance amongrt them. Also throw an exception if balance is less than 5000.

b) Explain applet life - cycle in detail, with suitable example and diagram.

c) Write a program to define a class student. Define appropriate mentods to accept and show the data. Define the fields in a class as roll, name, marks. Find out the student details having maximum marks. Accept minimum 5 records.

Q5) Attempt <u>any four</u> of the following: **[16]**

a) With suitable example and proper syntax differentiate while and do ... while loop.

b) Justify the following statements : Give proper explaination:
   i) Superclass constructors are not innerited by subclasses.
   ii) Inner classes are not allowed to access the members of enclosing class.

c) Explain the following terms:
   i) RMI Registry.
   ii) Stub.
   iii) Marshalling.
   iv) Bootstrapping.

d) For each of the following. Write a single statement code:
   i) Compare the string in str1 to the string in str2 ignoring their cases.
   ii) Find out length of a string.
   iii) Check if string str1 starts with "st".
   iv) To find a substring in string.

e) Comment : Java is platform independent language. Discuss any 2 features of java.

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