Total No. of Questions : 5]

SEAT No. : ____

P858

[Total No. of Pages : 4

[4139] - 103
M.Sc. (Sem. - I)
COMPUTER SCIENCE
CS - 103 : Distributed Databases Concepts
(2011 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 be drawn wherever necessary.***
5) ***Assume suitable data, if necessary.***

Q1) Attempt any eight from the following : **[8 × 2 = 16]**

a) Discuss any two complicating factors in design of DDBMS.

b) Write a short note on distributed catalog management.

c) Which criteria must be checked for correctness of primary horizontal fragmentation in design of distributed database ?

d) What are the objectives of query processing ?

e) List all the successive steps of query decomposition.

f) Define the join selectivity factor for a pair of relations R & S.

g) Explain the terms : i) Ship-whole data transfer
ii) Fetch-as-needed data transfer.

h) Give any two situations that can occur if proper isolation of transactions is not maintained.

i) Write down the sufficient conditions to ensure that two schedules are equivalent.

j) List any four types of failures that can occur in distributed databases.

Q2) Attempt any four from the following : **[4 × 4 = 16]**

a) Replication of data in distributed databases reduces reliability. Justify true or false.

b) Autonomy refers to distribution of control, not data comment.

P.T.O.

c) Fragmentation permits a number of transactions to execute concurrently. Justify true or false.

d) The order in which relational algebra operations are performed for evaluation of query does not affect performance of query comment.

e) The analysis phase of query decomposition is responsible for rejecting those queries, for which further processing is either impossible or unnecessary. Comment.

Q3) Solve any four from the following : **[4 × 4 = 16]**

a) Consider the following database :

PROJ (pno, pname, budget, location) and

ASG (pno, eno, duration, responsibility)

Consider, set of simple predicates,

p = { budget ≤ 500000,

budget > 500000}

Perform the horizontal fragmentation of PROJ based on set p. Using this fragmentation of PROJ, further perform derived horizontal fragmentation of ASG.

b) Consider the following database :

EMP (empno, ename, title) and

ASG (empno, pno, dur, resp)

Suppose EMP relation is horizontally fragmented as follows :

$EMP_1 = \sigma$ empno ≤ "e3" (EMP)

$EMP_2 = \sigma$ empno > "e3" (EMP)

Suppose ASG relation is horizontally fragmented as follows :

$ASG_1 = \sigma$ empno ≤ "e3" (ASG)

$ASG_2 = \sigma$ "e3" < empno ≤ "e5" (ASG)

$ASG_3 = \sigma$ empno > "e5" (ASG)

Transform the following query into a reduced query on fragments and determine whether it is better than the generic query.

SELECT ename, title, resp, pno.

FROM ASG, EMP

WHERE ASG. empno = EMP. empno and pno = "p1" ;

c) Consider the following query :

```
SELECT person_name
FROM person P. disease D. person_disease PD
WHERE P. ssnno = PD. ssnno
and PD. dno = D. dno
and dname = " SWINEFLU"
and P. age < 45;
```

Optimize the above query using centralised INGRES query optimization algorithm.

d) Consider a query that refers to join of relations

PROJ (pno, pname, budget, location) &

ASG (pno, eno, duration, responsibility) on ottribute pno.

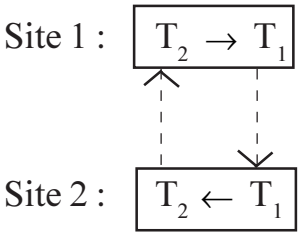
Assume that PROJ & ASG reside at two different sites, and index is on pno.

Consider size (PROJ) = 100 and size (ASG) = 200.

Write down all possible execution strategies along with cost incurred, if distributed system R algorithm (R*) is implemented.

Which is the best strategy amongst all & why ?

e) Consider the following Distributed wait-For-Graph



Detect the deadlock using distributed deadlock detection algorithm. Explain each step.

Q4) Attempt <u>any four</u> from The following. **[4 × 4 = 16]**

a) Let a = $\{q_1, q_2, q_3\}$ be a set of queries, A = $\{A_1, A_2, A_3\}$ be a set of attributes & S = $\{S_1, S_2\}$ be a set of sites. Consider the following matrices:

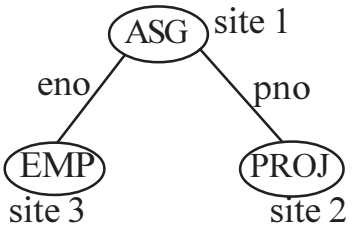
$$\begin{array}{c} \\ q_1 \\ q_2 \\ q_3 \end{array} \begin{array}{c} \begin{array}{ccc} A_1 & A_2 & A_3 \end{array} \\ \begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 0 \\ 1 & 0 & 1 \end{bmatrix} \end{array} \qquad \begin{array}{c} \\ q_1 \\ q_2 \\ q_3 \end{array} \begin{array}{c} \begin{array}{cc} S_1 & S_2 \end{array} \\ \begin{bmatrix} 12 & 10 \\ 0 & 20 \\ 30 & 0 \end{bmatrix} \end{array}$$

Usage matrix Access frequency matrix

Assume $ref_l(q_k) = 1 \forall q_k$ and S_l and A_1 is the key attribute. Use Bond Energy and vertical partitioning algorithm to obtain a vertical fragmentation of the set of attributes in A.

b) Explain the layers of query processing.

c) Consider the join graph given below for the relational algebra query PROJ $\bowtie_{pno}$ EMP $\bowtie_{eno}$ ASG



Using the information given below, describe a join program which will need minimum data transfer.

Size (EMP) = 200
Size (ASG) = 300
Size (PROJ) 100
Size (EMP $\bowtie$ ASG) = 200
Size (ASG $\bowtie$ PROJ) = 300

d) Consider a data item *x*. Let RTM (*x*) = 21 & WTM (*x*) = 20. Let the pair (<Ri (*x*), TS>, <wi (*x*), TS>) denote a read / write request of transaction Ti on item *x* with time stamp TS. Indicate the behavior of the basic time stamp method with following sequence of requests :-

$< R_1 (x), 22>$, $<R_2 (x), 26>$, $<R_3 (x), 19>$,
$<R_4 (x), 23>$, <w, (*x*), 30>, $<R_5 (x), 24>$.

e) Explain in-place update recovery in detail.

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

a) Explain Rewriting phase of Query decomposition with appropriate example.

b) What are the goals of transaction manager in distributed database systems?

c) Write a short note on "False deadlocks".

d) How site failures are handled in 2PC protocol if co-ordinator & participant fail when they are in INITIAL state and COMMIT/ ABORT state.

e) Discuss various types of information required in allocation of fragments to different sites.

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Total No. of Questions : 5]

SEAT No. :

P856

[Total No. of Pages : 4

[4139] - 101
M.Sc. (Sem. - I)
COMPUTER SCIENCE
CS - 101 : Principles of Programming Languages
(2011 Pattern)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***All questions carry equal marks.***
5) ***Assume suitable data if necessary.***

Q1) Attempt Any Eight : **[8 × 2 = 16]**

a) Under which two circumstances, bootstrapping is necessary ?

b) Evaluate the following terms:

i) (cadar' ((a b) (c d) (e f)))

ii) (cadadr' ((a b) (c d) (e f)))

c) Why prolog does not have generic read Predicate?

d) Consider the following C Program fragment:

```
int foo (int   bar) {return  bar + 1;}
```

Where is the value of the argument bar is allocated & stored at run time?

e) Justify True/False: "short - circuit evaluation can save time".

f) Why do many languages permit operations on strings (concatenation, dynamic re-sizing etc.) that they do not in general permit on arrays?

g) What is coroutine ? How does it differ from a subroutine?

h) Why won't C++ allow you to apply a dynamic-cast operator to an object of a class that has no virtual functions?

P.T.O.

i) Consider the following fragment of code in C:

```
{ int a, b, c;
  { int d,e;
      { int f; }
  }
  {   int g, h, i;
  }
}
```

Assume that each integer variable occupies 4 bytes. How much total space is required for the variables in this code?

j) Define

i) Competition Synchronization

ii) Cooperation Synchronization

Q2) Attempt any four: **[4 × 4 = 16]**

a) Explain how an IDE differs from a collection of command-line tools.

b) Write a C/C ++ function that declares an array statically, on the stack, and on the heap. Which one is likely to be more efficient?

c) Explain different ways in which boolean expressions are evaluated with the help of suitable example.

d) Write a C/C++ code to generate garbage and dangling reference on stack.

e) Explain how shared multiple inheritance is implemented with suitable diagram.

Q3) Attempt any four **[4 × 4 = 16]**

a) In the producer consumer problem, suppose that we incorrectly replaced the release (access) in the consumer process with wait (access). What would be the result of this error on execution of the system?

b) What is tail recursion? Apply tail recursion optimization on the following function:

```
int foo (int  n) {
    if (! n) return 1;
    if (! (n  %2)) return 2* foo (n/2);
    return foo (n-1);
}
```

c) What is a descriptor ? Give descriptors for static string, limited dynamic string, and dynamic string.

d) Consider the following pseudocode, assuming value model of variables. What will be printed by the program if parameters are passed by

i) value ii) reference

iii) name iv) value-result ?

```
a : int : = 0; b: int : = 1;
Void  foo (i : int , j: int)
_____i : = i + 1;
_____ Print a + i, j;
foo (a, a + b);
Print a;
```

e) Explain fragile base class problem with the help of suitable C++ code.

Q4) Attempt any four **[4 × 4 = 16]**

a) Explain discriminated & free unions with the help of suitable diagram.

b) Assume that class D is inherited from class A,B, and C, none of which share a common ancestor. Show how data members and v tables of D might be laid out in memory. Show how to convert reference to a D object into a reference to an A, B, or C object.

c) Assume that language permits nested subroutines & also allows subroutines passed as a parameter to another subroutine- list & explain 3 choices for deciding referencing environment for a subroutine passed as a parameter.

d) Explain what sequence of events are possible and what values result in the absence of competition synchronization for the given Scenario: "Assume the initial value of Buf-size is 6. Suppose two tasks A and B must use the shared variable Buf-size. Task A adds to Buf-size value 2, & task B subtracts 1 from it. Assume that such arithmetic operations are done by the three-step process of fetching the current value, Performing the arithmetic, & putting the new value back.

e) Explain scope rules & binding rules with suitable example.

Q5) Attempt any four: **[4 × 4 = 16]**

a) Define a recursive LISP function to find difference of two lists taken as arguments.

b) Define a recursive LISP function to merge two sorted lists e.g.

(Merge' (1 2)' (0 3 5)) (returns (0 1 2 3 5)

c) Write a prolog program which uses red cut.

d) Write a tail recursive prolog program to print numbers from n to 1.

e) Consider the following sentences:

"John likes all animals. Cat, bird, dog, and snake are animals. Write a prolog program such that goal likes (john, snake) return false; whereas, for other animals it will return true.

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Total No. of Questions : 5]

SEAT No. :

P861

[Total No. of Pages : 4

[4139] - 202
M.Sc. (Sem. - II)
COMPUTER SCIENCE
CS - 202 : Advanced Operating Systems
(2011 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) ***Assume suitable data if necessary.***

Q1) Attempt all of the following : **[8 × 2 = 16]**

a) State the characteristics of the UNIX file system.

b) Explain any four fields of disk inodes.

c) Give the components of register context in brief.

d) Explain the working of read v () and write v () functions.

e) What are the several benefits of allocating memory via anonymous mappings?

f) Give the division of windows priority levels with suitable diagram.

g) Explain the sigqueue () function. Also state its syntax.

h) Define: symmetric multiprocessing (SMP) and asymmetric multiprocessing (ASMP).

Q2) Justify the following: (any Eight) **[8 × 2 = 16]**

a) Symbolic links incur more overhead than hard links.

b) The kernel unlocks the inode at the end of each system call that it uses.

c) The idle process is actually a process that gets run.

d) Windows is a portable operating system.

e) The timeslice to each process is an important variable in the over all behavior of system.

f) At the kernel level, support for protected process is two fold.

g) It is very important that any signal handler has to be very careful about the actions it performs and the data it touches.

P.T.O.

h) The new thread pool implementation increases the scalabilily of applications.

i) A process can access its u area when it executes in kernel mode but not when it executes in user mode.

j) In linux the files are usually accessed via file names.

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

a) Write a note on preemptive thread scheduling.

b) Explain the different types of memory regions found in every process.

c) State the different cases in which windows scheduler can boost (increase) the current priority value of threads.

d) Give the description of following signals:

i) SIGKILL ii) SIGSEGV

iii) SIGTERM iv) SIGTRAP

e) Explain the four basic types of user-mode processes.

Q4) Explain the behavior of following "C" programs (any four): **[4 × 4 = 16]**

a)
```
# include < fontl - h >
main ()
{
    int fd;
    char lilbuf [20], bigbuf [1024];
    fd = open ("/etc/passwd", O_RDONLY);
    read (fd, lilbuf, 20);
    read (fd, bigbuf, 1024);
    read (fd, lilbuf, 20);
}
```

b)
```
# include <signal. h>
main()
{
    register int i;
    setpgrp ();
    for (i = 0; i<10; i ++)
    {
        if (Fork () = = 0)
        {
            if (1&1)
                set pgrp ();
            Print f ("pid = % d pgrp = % d", getpid (),  getpgrp () );
```

```
                    Pause();
                }
            }
            kill (O, SIGINT);
        }
```

c)
```
    # include.<fontl.h>
    main ()
    {
        int fd1, fd2;
        char buf1 [512], buf2 [512];
        fd1 = fopen ("/etc/passwd", O _ RDONLY);
        fd2 = open ("/etc/passwd", O _ RDONLY);
        read (fd1, buf1, size of (buf1)) ;
        read (fd2, buf 2, size of (buf 2)) ;
    }
```

d)
```
    main ()
    {
        int child;
        if ((child = = fork ()) = = 0)
        {
            print f ("child PID % d\n", get pid ());
            pause ();
        }
        print f ("child PID % d\n", child);
        exit (child);
    }
```

e)
```
    # include. <fontl.h>
    int fdrd, fdwt;
    char C;
    main (int argc, char *argv[])
    {
        if (argc ! = 3)
            exif();
        if ((fdrd = = open (argv [1], O_RDOMLY))= = -1)
                exit(l);
        if ((fdwt = = create (argv[2], 0666)) = = –1)
                exit(1);
        fork ();
```

```
        rdwrt();
        exit(0);
    }
    rdwrt ()
    {
        for (;;)
        {
            if (read (fdrd, &c,1) 1 =1)
                return
            write (fdwt, &c,1);
        }
    }
```

f)
```
# include < signal .h>
main (intargc, char * argv[])
{
    char buf [256];
    if (argc! = 1)
        Signal (SIGCLD, SIG_IGN);
    While (read (0, buf, 256))
        if (fork () = = 0)
        {
            exit(0);
        }
}
```

Q5) Write a C program for the following: (any four) **[4 × 4 = 16]**

a) Write a program that prints out the inode number of a given file.

b) Write a program to demonstrate. Use of a texit() function.

c) Write a program to demonstrate race condition in catching signals.

d) Write a program to show the behavior of wait() function.

e) Write a program to print the names of the signal in the signal mask of the calling process.

f) Write a program to protect a critical region of code from a specific signal.

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Total No. of Questions : 5]

SEAT No. : ____

P846

[Total No. of Pages : 2

[4139] - 11
M.Sc. (Sem. - I)
COMPUTER SCIENCE
Principles of Programming Languages
(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.***
3) ***All questions carry equal marks.***
4) ***Assume suitable data, if necessary.***
5) ***All questions are compulsory.***

Q1) Attempt all : **[8 × 2 = 16]**

a) What is P-code? What is JIT compiler?

b) Define binding's life time & object's life time.

c) Write any two applications of prolog.

d) When to use let* instead of let in LISP.

e) What is multiway assignment operator? List one language which uses it.

f) What is garbage? Why is it a problem?

g) What is 'this' in OOPLs?

h) What is mutual exclusion? What is a critical section?

Q2) Attempt any four : **[4 × 4 = 16]**

a) Do you think coercion is a good idea? Why or why not?

b) Give two concrete examples in C where a variable is live but not in scope.

c) Explain binding rules and scope rules.

d) What is short-circuit evaluation? Why is it useful?

e) Give an example in which a midtest loop results in more elegant code than does a pretest or post-test loop.

P.T.O.

Q3) Attempt any four : **[4 × 4 = 16]**

a) What does it mean for a language to be strongly typed? Statically typed? What prevents C from being strongly typed?

b) Discuss structural & name equivalence in detail.

c) Explain "holes" in records. Why do they arise? What problems do they cause?

d) What is a conformant array? What is a dope vector?

e) Describe static chain & displays in detail.

Q4) Attempt any four : **[4 × 4 = 16]**

a) Why are there so many programming languages.

b) Explain run-time polymorphism with suitable example

c) Explain nonrepeated multiple inheritance with the help of suitable diagram.

d) Explain various parameter passing techniques in detail.

e) What is a monitor? How do monitor variables differ from those of semaphores?

Q5) Attempt any four : **[4 × 4 = 16]**

a) Give 4 differences between C & Prolog.

b) Write a prolog program which uses recursion to print a string in reverse.

c) Consider the following sentences :

"John likes all kinds of food. Chicken is food. Apples are food. Anything any one eats and is still alive then whatever he ate was food. Bill eats peanuts & is still alive. Sue eats everything Bill eats.

Write a prolog program to prove that John likes peanuts & to answer the question "What food does Sue eat"?

d) Define a recursive LISP function to return summation of all elements of L takes as argument.

e) Define a recursive LISP function to return power x^y, where x & y are passed as argument.

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Total No. of Questions : 4]

SEAT No. : ____

P847

[Total No. of Pages : 2

[4139] - 12

M.Sc. (Sem. - I)

COMPUTER SCIENCE

Object Oriented Software Engineering

(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.***
3) ***Assume suitable data, if necessary.***
4) ***All questions are compulsory.***

Q1) Attempt the following : **[8 × 2 = 16]**

a) What is grouping things?

b) Explain two ways to apply UML.

c) What are the differences between classes and use cases?

d) What are the advantages of link attributes?

e) How subsystem can be organized?

f) What is an iterative development?

g) Acceptance test is done by customer site - comment.

h) What is the effect of a qualifier?

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

a) Explain forward and Reverse Engineering with suitable example.

b) Discuss the components of Activity diagram.

c) What is multiplicit? Explain with suitable example.

d) Explain the phases in iterative object oriented development.

e) What are the different types of relationship supported in UML?

P.T.O.

Q3) Attempt any four of the following : **[4 × 8 = 32]**

a) Prepare object diagram showing atleast 7 relationships among the following object classes. Show multiplicity and add atleast one attribute to each object class. file system, file directory, ASCII file, disk, drive, track, sector, executable file.

b) Draw a class diagram for "Mobile Company". They have different distributors at different areas. Different facilities are provided such as incoming free call, sending emails, mobile to mobile free call if same companies mobile, songs. etc. clearly specify the assumptions made.

c) Draw use case diagram for chatt window.

d) Draw sequence diagram and state diagram for a Telephone line.

e) Draw a component and deployment diagram for E-purchasing. Which is distributed over the network Where the users can purchase different items. Specify the functionalities supported by each component.

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

a) Explain object oriented testing strategy.

b) Discuss the generic components of the object oriented Design model.

c) Explain how a usecase model helps in analysis phase from inception to Elaboration.

d) Draw a collaboration diagram for "Result System".

e) Draw state diagram for tea / coffee making machine.

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Total No. of Questions : 4]

SEAT No. : ____

P848

[Total No. of Pages : 4

[4139] - 13

M.Sc. (Sem. - I)

COMPUTER SCIENCE

Distributed Database Concepts

(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) Answer the following in short : **[8 × 2 = 16]**

a) Distribution of data increases availability comment.

b) What are the three dimensions based on which we get various architectural alternatives in DDBMS.

c) What is hybrid fragmentation?

d) What information is required to be collected to make the decision regarding allocation of fragments?

e) Define :

   i) Linear tree.

   ii) Bushy tree

f) What are the desirable properties of time-stamp? Explain each one in brief.

g) What are the types of failures which may occur in distributed environment?

h) Define :

   i) Dirty read.

   ii) Cursor stability.

P.T.O.

Q2) Attempt any four : **[4 × 5 = 20]**

a) What are different problem areas which are required to be handled by DDBMS? Explain any one in detail.

b) Why data fragmentation is required?

c) Write note on : Join ordering in distributed environment.

d) What is query optimization? Explain the components of query optimization.

e) Give the classification of transaction based on the order of read and write operation in it.

Q3) Attempt any four : **[4 × 6 = 24]**

a) For the following queries find out why an optimizer will not be able to find out an optimum query evaluation plan. Rewrite the query so that the optimum evaluation plan can be found out

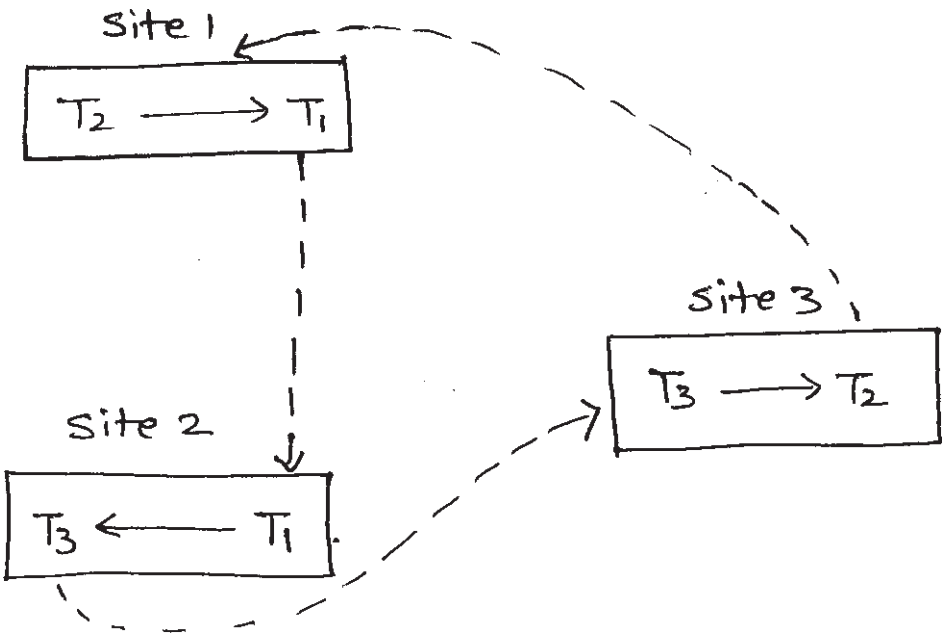
i) Select distinct *
from student
where class = “B.Sc.”
and age > 20

ii) Select S-name
from student
where class = “B.Sc.”
or age > 20

iii) Select S-name
from student, marks
where student. r-no = mark. rno
and student. age > 20

b) Consider the following query
Select student. name
from student, teacher, S - t
where student. r-no = S-t. rno
and teacher. t-no = S-t. tno
and student. age > 18
and S-t. subject = “Comp. Sci”
Apply Ingres algorithm to this query and optimize its execution.

c) Consider the following DWFG



Detect the deadlock if any using distributed deadlock detection algorithm.

d) Consider the following database

EMP (eno, ename, age, salary, duo)

DEPT (dno, dname, budget)

The queries which are executed frequently are as follows.

At site S_1, the frequently executed query tries to access the information of departments having budget > 2,00,000 Also, it accesses the employees belonging to the same departments.

At site S_2 the frequently executed query tries to access departments having budget < = 2,00,000 & employees of those departments. Perform the horizontal fragmentation of DEPT based on the predicates of frequently executed queries. Also, perform derived fragmentation of EMP.

e) The time stamps of data item a are as follows

RTS(a) = 25 WTS(a) = 22

If the following sequence of requests is issued by transaction manager, what will be the behaviour of Basic Time Stamp Ordering algorithm.

< R(a), 25 >, < W(a), 24 >, < W(a),25 >,

< W(a), 27 >, < R(a), 26 >, < W(a), 23 >

where the request is of the form < operation, time stamp of transaction trying to perform operation >.

Q4) Attempt any four : **[4 × 5 = 20]**

a) Explain primary copy 2PL protocol and state its advantages and disadvantages.

b) Explain how abort, commit and recover commands are handled in No-fix / Flush algorithm.

c) Explain voting based protocol to handle network partitioning.

d) What are the correctness rules of fragmentation? Explain each one in detail.

e) Explain various isolation levels of transaction.

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Total No. of Questions : 4]

SEAT No. : ____

P849

[Total No. of Pages : 3

[4139] - 14
M.Sc. (Sem. - I)
COMPUTER SCIENCE
Design and Analysis of Algorithms
(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.***
3) ***All questions are compulsory.***

Q1) Attempt all of the following : **[2 × 8 = 16]**

a) Asympotic notation Ω is transitive. Justify.

b) Define P and NP class problem.

c) Give recurrence relation in general for computing complexity of divide and conquer algorithm.

d) Define articulation point and bridge edge.

e) What are implict and explict constraints for 8 queen's problem?

f) Define Live node and Dead node.

g) What is flow network?

h) Partial solutions obtained during Kruskal's algorithm are also trees Justify.

Q2) Attempt any four of the following : **[4 × 5 = 20]**

a) What do you mean by time and space complexity? Among quick sort, Insertion sort and Heap sort which algorithm is best to sort data and why?

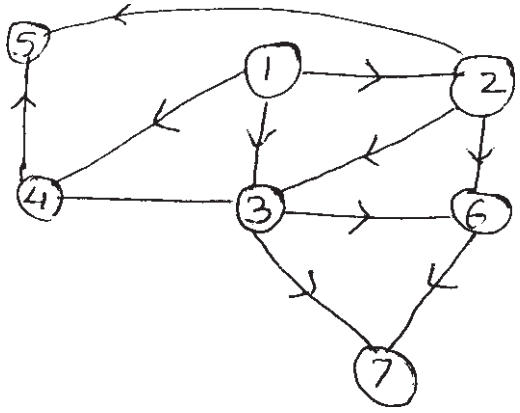
b) What is divide and conquer strategy? Write an algorithm to find X^n using divide and conquer method.

c) What is optimal merge pattern problem? Find optimal merge pattern for 10 files whose length are 28, 32, 12, 5, 84, 53, 91, 35, 3, 11.

P.T.O.

d) Consider the knapsack instance n = 4, m = 19
$(W_1, W_2, W_3, W_4) = (10, 15, 6, 9)$
$(P_1, P_2, P_3, P_4) = (2, 5, 8, 1)$
Find optimal solution of 0/1 knapsack problem using merge and purge method.

e) What is topological sort? Show the ordering of vertices produced by topological sort on the following diagraph. [start at vertex 1]



Q3) Attempt any four of the following : **[4 × 5 = 20]**

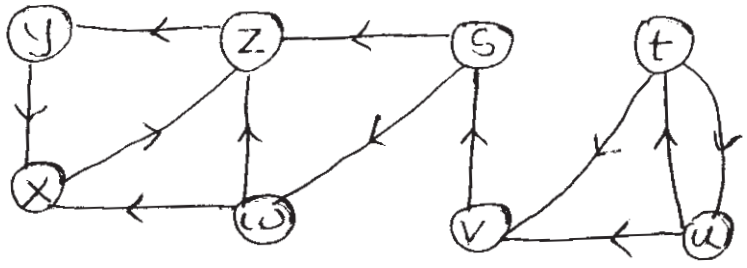
a) Show that recurrence relation
$T(n) = mT(n/2) + an^2$ is satisfied by $T(n) = O(n^{\log m})$

b) What is Knapsack problem? Justify that "All optimal solutions will fill the Knapsack exactly".

c) Explain the functions that characterize a nondeterministic algorithm.

d) Give the bounding function for backtracking solution to sum of subset problem
Let W = {5, 7, 10, 12, 15, 17} M = 22
Draw state space tree using fixed tuple size and find all subsets that sum to 22.

e) Define four types of edges in terms of Depth first spanning tree. Illustrate all four types of edge in following graph : [start from vertex S]

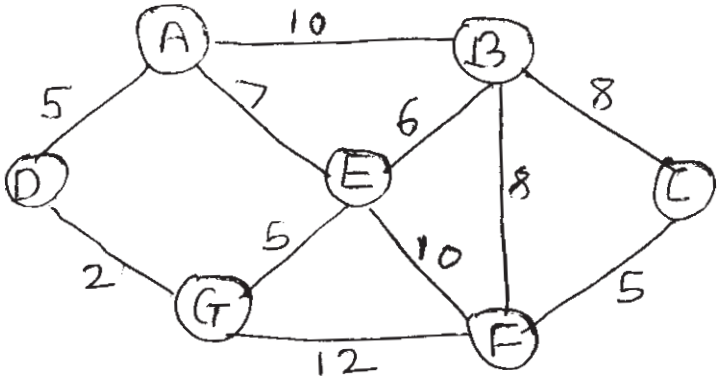


Q4) Attempt any four of the following : **[4 × 6 = 24]**

a) Consider the travelling salesman problem instance defined by the following cost matrix. Obtain the reduced cost matrix. Which node will be next selected in LCBB method.

$$\begin{bmatrix} \infty & 20 & 30 & 10 \\ 15 & \infty & 16 & 4 \\ 3 & 5 & \infty & 2 \\ 19 & 6 & 18 & \infty \end{bmatrix}$$

b) Apply Prim's and Kruskal algorithm to obtain minimum spanning tree for the following graph.



c) What is Hamiltonian cycle? Write an algorithm to find Hamiltonian cycle in a graph.

d) What is principle of optimality? How dynamic programming can be used to solve problems that exhibit optimal structure?

e) What is all pairs shortest path problem? Write an algorithm to find all pairs shortest path in a graph.

f) Explain string editing problem. Give recurrence relation for value of optimal solution using dynamic programming for strings

X = (b, b, a, b, a)

Y = (a, b, a, a)

Give matrix of values computed in bottom up manner.

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Total No. of Questions : 5]

SEAT No. : ____

P850

[Total No. of Pages : 2

[4139] - 21
M.Sc. - I (Sem. - II)
COMPUTER SCIENCE
Advanced Networking Concepts
(2008 Pattern)

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

Instructions to the candidates:

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

Q1) Attempt all of the following : **[8 × 2 = 16]**

a) Define the role of speaker node in path vector routing.

b) List the applications of TFTP.

c) Discuss the problems of X.25 WAN.

d) How time stamp option is used to record the time of datagram processing by a router.

e) Define remote procedure call.

f) Define out of band signaling.

g) How error control is accomplished in BOOT P?

h) IP is best effort delivery protocol. Justify.

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

a) Explain how caching speeds up the operation of DNS? Which technique is used by server to avoid sending outdated mapping.

b) Discuss the architecture & need of frame relay network.

c) Explain the use of priority & flow label fields of IPv6.

d) Discuss various options used by DHCP.

e) Explain the control characters used for option negotiation in TELNET.

P.T.O.

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

a) Discuss the symmetric & asymmetric connection release of transport layer.

b) Why do we need an RRQ or WRQ message in TFTP but not in FTP.

c) Explain the significance of link state update packet. Why it is called the heart of OSPF operation.

d) Can the calculated sending time, receiving time or round trip time have a negative value? Why or why not? Give example.

e) Explain RIP protocol in detail.

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

a) Show the message transfer phase from aaa@xxx.com to bbb@yyy.com. The message is "Good morning".

b) Explain Tomlinson's solution for transport connection establishment.

c) Discuss the socket primitives used for TCP.

d) Explain all headers used in HTTP.

e) Discuss the all scenarios for connection release in transport layer.

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

a) Discuss the "Tracking the callee" procedure used in SIP.

b) Explain any two approaches used in streaming stored audio/video.

c) Explain SNMP message in detail.

d) Explain with eg. the dynamic buffer allocation of transport layer.

e) Explain the socket interface for connection oriented concurrent server.

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Total No. of Questions : 5]

SEAT No. : ____

P851

[Total No. of Pages : 3

[4139] - 22
M.Sc. (Sem. - II)
COMPUTER SCIENCE
Unix Internals
(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.***
3) ***All questions carry equal marks.***
4) ***Assume suitable data, if necessary.***
5) ***All questions are compulsory.***

Q1) Attempt all of the following : **[8 × 2 = 16]**

a) What is tie-breaker rule for processes with equal priority?

b) State the function of line disciple.

c) mknod ("fifo", 010777,0);
Explain significance of each digit in the parameter '010777.

d) "Lseek can be used with pipes" comment.

e) How and when the remembered inode is updated?

f) What is the use of memory management register triple.

g) State the conditions for generation of signals.

h) Why are the timers used to calculate scheduling priority in process table and not in u-area?

Q2) State whether following statements are true or false. Justify your answer (any four) : **[4 × 4 = 16]**

a) A debugger process can not trace several child process simultaneously.

b) Fork system call physically duplicates all regions of process.

c) During create system call, the kernel writes the directory with new name to disk before it writes newly allocated inode to disk.

d) Inode of a special file is not locked while the kernel executes the driver.

e) Written data is contiguous in the pipe if other processes write their data to the pipe before the process resumes its write.

P.T.O.

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

a) For following sequence of blocks use getblk algorithm to allocate a buffer for a disk block. Explain with neat diagram, all the scenarios for retrival of buffer.

Existing sequence & status is

(16 - busy) (32 - busy) (36 - free) (48 - busy) (8 - free) (65- free delayed write) (05 - free delayed write) (50 - free) (86 - free)

Request for allocation for block number 48, 20, 36, 24

b) If super block is not locked then discuss the race condition arises in reading a new set of free idones.

c) What are the different steps taken by Kernel to attach region to process.

d) Parent process never waits for the termination of its child process. Why?

e) Explain algorithm for setjump and longjumb.

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

a) Write an utility program that deals directly with the disk.

b) Write the behaviour of the following program main( )

```
{     int fp;
      char user_buff [20];
      fp = open (“Computer”, ORDONLY);
      Pid = fork();
      if(pid = = 0)
      { printf(“File Handle is %d \n”, 1seek (Fp,01,1));
        read (Fp, user_buff, 10);
        user_buff [11] = ‘10’;
        Printf(“file handle is now %d in the child
            process \n”, 1seek(Fp, 01, 1));
      }
      else
      {wait (0)
      printf(“File Handle in parent process is
                  % d \n”, 1seek (Fp, 01,1));
      }
}
```

c) The command nice causes the subsequent command to be invoked with the given nice value as -
nice 6 nroff-mm big-memo > output write C program for the nice command.

d) Write C program to catch death of child signals.

e) Write a program that prints the owner, file type, access permission and access times of files supplied as parameters. If a file is directory, the program should read the directory and print the above information for all files in the directory.

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

a) Explain various system calls for messages.

b) Describe all conditions where the reference count of an inode can be greater than 1.

c) Why the events “waiting for buffer to becomes free” and “awaiting for completion” map into the same sleep address.

d) Describe implementation of kill system call.

e) What is stream? How kernel implement a stream for read/write operations on device.

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Total No. of Questions : 5]

SEAT No. : ____

P852

[Total No. of Pages : 2

[4139] - 23
M.Sc. (Sem. - II)
COMPUTER SCIENCE
Software Architecture
(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.***
4) ***Figures to the right indicate full marks.***
5) ***Assume suitable data, if necessary.***

Q1) Attempt all of the following : **[8 × 2 = 16]**

a) State the benefits of Iterative development life cycle.

b) "Architecture is a transferable reusable model". Justify.

c) What are the specializations in pipe and filter Architectural style?

d) Give organization of Design Pattern Catalog.

e) List out the applicability of Abstract Factory Design Pattern.

f) Which are the knowing responsibilities in GRASP?

g) "MVC model is responsible for the business domain state knowledge". Justify.

h) Define-Component.

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

a) "A Unified process project organizes the work and iterations across different phases." Justify.

b) Discuss Allocation Architectural Structure.

c) What is Heterogeneous Architectures?

d) Write a short note on Interpreter Architectural style.

e) How pattern supports software Architecture?

P.T.O.

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

a) Give intent, participants, and implementation of singleton Design pattern.

b) "Facade Design pattern provide a multiple interfaces to a set of interfaces in a system". Justify.

c) Discuss applicability and consequences of Strategy Design Pattern.

d) Although paintings can be hung on a wall with or without frames, frames are often added and it is the frame which is actually hung on the wall. Prior to hanging, the painting may be matted and framed, with the painting, matting, and frame forming a single visual component.
Apply the appropriate Design pattern to the above example and draw the class Diagram.

e) With the help of suitable example, explain high cohesion GRASP.

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

a) Write a short note on Indirection GRASP.

b) "Using polymorphism extension required for new variations are easy to add" Justify.

c) Draw a neat diagram of struts framework.

d) What are the duties performed by MVC Controller in a Web Tier Application?

e) Define and state characteristics of framework.

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

a) Which are the different approaches for component based developement?

b) "The struts framework use single resource area to store objects". Justify.

c) Write a short note on Maverick Framework.

d) A sample struts application is to be designed for a login form containing the fields such as user name, password, and personal identification no. Further confirmation requires user to enter date of birth for successful registration. If registration is successful then a success page is displayed otherwise a failure page is displayed.
Give the steps in designing the application and the components to be created.

e) A registration form contains information such as name, email address, birth date, credit card number, salary out of which name and email address are essential fields.
Discuss the basic validators that can used with above action form.

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Total No. of Questions : 5]

SEAT No. : ____

P853

[Total No. of Pages : 2

[4139] - 31
M.Sc. (Sem. - III)
COMPUTER SCIENCE
Software Metrics and Project Management
(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.***

Q1) Attempt the following : **[8 × 2 = 16]**

a) What do you mean by project stake holders?

b) Define CCB.

c) What is NPV and ROI?

d) Define PERT.

e) State processes involved in Project Quality management.

f) Define i) Earned value ii) Cost variance

g) What are different categories of Risk?

h) Define i) CPIF ii) CPFF

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

a) Explain framework of project management with neat diagram.

b) Explain main processes involved in project Integration management.

c) State purpose of project charter with example.

d) Which are different types of cost estimation? What are the outputs of cost estimation process?

e) State processes involved in Project Quality Management.

P.T.O.

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

a) "Effective project manager must be a good team leader" Justify.

b) Write a short note on conflict management.

c) Write a short note on solicitation planning.

d) State importance of GQM and explain it with example.

e) State the activities involve in data analysis. Explain sampling & data distribution technique.

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

a) "In managing risk, the first is to take action to increase the like hood of the risk occurring" Justify.

b) State the important processes involved in HR management.

c) State five major cost categories related to quality.

d) Explain the processes involved in time management.

e) Which are different key process areas in CMM? Explain their goals.

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

a) Which are different approaches used to develop WBS.

b) Write short note on performance reporting of communication management.

c) What is metrics Plan? What are the different changes considered while revising the plan?

d) Differentiate between software reliability and Hardware reliability.

e) Explain in brief levels of process maturity.

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Total No. of Questions : 5]

SEAT No. : ____

P854

[Total No. of Pages : 2

[4139] - 32
M.Sc. (Sem. - III)
COMPUTER SCIENCE
Mobile Computing
(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) ***Neat diagrams must be drawn wherever necessary.***

Q1) Attempt all of the following : **[16]**

a) What is the purpose of display class in J2ME?

b) What is good code for CDMA?

c) What is RTT problem in GSM? How it can be resolved?

d) What are the advantages of spread spectrum technology?

e) What is COA?

f) Define : Soft handover, hard handover.

g) What is the purpose of Record Enumeration in J2ME?

h) What are the functions of Gateway GSN in GPRS?

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

a) What are the advantages and disadvantages of cellular system?

b) Name all entities with their functionality in GSM.

c) Explain Packet Reservation multiple Access (PRMA) scheme.

d) What is snooping? Why it is used in TCP?

e) Why is routing in multihop and hoc network is complicated?

P.T.O.

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

a) Explain architecture of GPRS.

b) Explain Coda file system.

c) How Care-Of-Address (COA) mechanism is used in mobile IP?

d) What is the purpose of following optimizations for TCP?

i) Indirect -TCP ii) Snooping TCP

iii) Mobile TCP iv) Transaction-oriented TCP

e) Explain WAP architecture.

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

a) How localization is achieved in GSM?

b) Define following terms used in mobile IP

i) Tunneling ii) Reverse Tunneling

iii) Smooth Handover iv) Simultaneous Binding

c) What are the constraints possible on Text Box in J2ME?

d) What are the features of WML?

e) What is the purpose of cellular IP? What are its advantages and disadvantages?

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

a) What are the advantages of IPv6 in mobile IP?

b) Explain WTLS.

c) Explain the logical reference model of location services.

d) What improvements are needed in TCP for 2.5/3G networks?

e) What is profile in J2ME? Name all profiles that J2ME supports? What facilities MIDP profile provides?

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Total No. of Questions : 5]

SEAT No. : ____

P855

[Total No. of Pages : 2

[4139] - 33
M.Sc. (Sem. - III)
COMPUTER SCIENCE
Information Systems Security
(2008 Pattern)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All question carry equal marks.***
3) ***Neat diagrams must be drawn wherever necessary.***

Q1) Attempt all of the following : **[8 × 2 = 16]**

a) Define i) Release of message contents
ii) Traffic analysis

b) How Homophonic substitution cipher works?

c) What is self signed digital certificate?

d) Distinguish between confusion & diffusion.

e) List the different steps of digital certificate creation.

f) Give the transformation of a message using rail fence technique.
"The International Data Encryption Algorithm is perceived as one of the strongest cryptographic algorithms."

g) How challenge Response tokens are used for authentication.

h) What is CRL? Give its usage.

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

a) Explain the key transformation & expansion permutation process in DES.

b) Given two prime numbers P = 11 & Q = 7. Find out N.E. & D in an RSA encryption process.

c) Discuss X.800 security mechanisms.

d) Apply play fair cipher on plain text "University of Pune" & use keyword as "Attack".

e) How SSL achives confidentiality & integrity?

P.T.O.

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

a) How firewall perform Network address translation?

b) What is message digest? Explain the key requirements of message digest.

c) Explain the working of secure hash algorithm.

d) Why digital certificate revocation is needed? How online certificate revocation status check is done?

e) How does certificate based authentication works?

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

a) Explain the working of RC5.

b) Discuss the different steps used for every round of AES.

c) Is is possible to combine the symmetric & asymmetric key cryptography? Justify your answer.

d) Explain the purchase request transaction supported by SET.

e) What is VPN? Explain it's architecture.

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

a) How can we verify a digital certificate?

b) Explain the working of Kerberos.

c) Why is anonymous offline electronic money dangerous? Discuss the double spending problem?

d) By using vernam cipher convert the plaintext into cipher text

Plain text : Information systems

One time pad : NCBTZQARXYPEMSVDFH

e) Explain the AH & ESP protocols.

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Total No. of Questions : 5]

SEAT No. : ____

P857

[Total No. of Pages : 3

[4139] - 102
M.Sc. (Sem. - I)
COMPUTER SCIENCE - I
CS - 102 : Advanced Networking
(2011 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 be drawn wherever necessary.***
5) ***Assume suitable data, if necessary.***

Q1) Attempt any eight : **[8 × 2 = 16]**

a) The value of HLEN in an IP datagram is 7. How many option bytes are present?

b) In RIP, why is the expiration timer value six times that of the periodic timer value?

c) Why does the maximum packet lifetime, T, have to be large enough to ensure that not only the packet but also its acknowledgements have vanished?

d) Can we say UDP plus RTP is the same as TCP? Why or Why not?

e) What would be the transformation of a message “Happy Birthday to you” using Rail Fence technique?

f) What is masquerade? Which principle of security is breached because of that?

g) What is an Initialization Vector (IV)? What is its significance?

h) Which are the key participants in SET?

i) What is electronic money?

j) What is the problem with smart cards if large data needs to be processed?

P.T.O.

Q2) Attempt any four : **[4 × 4 = 16]**

a) An ethernet MAC sublayer receives 1510 bytes of data from the LLC sublayer. Can the data be encapsulated in one frame? If not, how many frames need to be sent? What is the size of the data in each frame?

b) Consider the problem of recovering from host crashes. If the interval between writing and sending an acknowledgement, or vice versa, can be made relatively small, what are the two best sender - receiver strategies for minimizing the chance of a protocol failure?

c) An IP datagram has arrived with the following information in the header (in hex). 45000054000300002006000007C4E0302B40E0F02

i) Are there any options?

ii) Is the packet fragmented

iii) What is the type of service?

iv) Is a checksum used?

d) Why is anonymous offline electronic money dangerous? Explain the double spending problem.

e) Consider a plain text message I AM A HACKER. Encrypt it with the following :

i) Replace each alphabet with its equivalent 7-bit ASCII code.

ii) Add a 0 bit as the leftmost bit to make it 8-bit long.

iii) Swap first 4 bits with last 4 bits for each alphabet.

iv) Write the hex equivalent for every 4 bits.

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

a) Suppose that the TCP congestion window is set to 18 KB and a timeout occurs. How big will the window be if the next 4 transmission bursts are all successful? Assume that the maximum segment size is 1 kB.

b) A router running RIP has a routing table with 20 entries. How many periodic timers are needed to handle this table? How many expiration timers are needed to handle this table? How many garbage collection timers are needed to handle this table if five routes are invalid.

c) By applying RSA algorithm, create public & private keys. Assume, P = 11, & Q = 23.

d) How is screened host firewall, dual-homed bastion different from screened host firewall, single-homed bastion? Explain.

e) Compare & contrast error-reporting, & neighbor discovery messages ICMPv6 with those in ICMPv4.

Q4) Attempt any four : **[4 × 4 = 16]**

a) Explain SIP. Is there any drawback to prevent using SIP for video? Justify.

b) Compare and contrast distance vector routing with link state routing.

c) Explain key principles of security.

d) Consider a situation : an attacker (A) creates a certificate, puts a genuine organization's name (say bank B) and puts the attacker's own public key. You get this certificate from the attacker, without knowing that the attacker is sending it. You think it is from the bank (B). How can this be prevented or resolved?

e) When is a Demilitarized Zone (DMZ) required? How is it implemented?

Q5) Attempt any four : **[4 × 4 = 16]**

a) Why does UDP exist? Would it not have been enough to just let user processes send raw IP packets? Explain in detail.

b) What is the size of a RIP message that advertises only 1 network? What is the size of a RIP message that advertises N packets? Device a formula that shows the relationship between the no. of networks advertised and the size of a RIP message.

c) Explain the security handshake pit falls.

d) Mention the broad level steps in PEM & PGP.

e) Explain the steps in various rounds of AES.

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Total No. of Questions : 5]

SEAT No. : ____

P859

[Total No. of Pages : 3

[4139] - 104
M.Sc. (Sem. - I)
COMPUTER SCIENCE
CS - 104 : Design and Analysis of Algorithms
(2011 Pattern)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Neat diagrams must be drawn whenever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

Q1) Attempt any eight from the following : **[8 × 2 = 16]**

a) Find n_0 such that for all $n > n_0$ the following is true $3\log_2 n < 4n < n^2$.

b) Justify : $4n^2 + 3n + 2 = 0(n^2)$.

c) Give control abstraction for divide and conquer strategy.

d) With respect to greedy method, define optimal solution.

e) Define priciple of optimality.

f) State the applications of BFS & BFT.

g) Define state space tree and a problem state.

h) Give the bounding function for 0/1 knapsack problem using branch and bound method.

i) State Horner's rule for Sparse Representation.

j) Is the formula $(\sim p) \wedge (p \vee q) \wedge (\sim q)$ satisfiable. Justify.

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

a) Order the following functions in non-increasing order of their growth rate n^2, e^n, 4^n, n!, $10n + 5 \log_e n$

b) Show how merge sort algorithm sorts the following sequences of keys 35, 20, 15, 8, 14, 40, 3, 50, 4

c) Find an optimal binary merge pattern for 10 files whose lengths are 15, 2, 12, 35, 28, 11, 23, 5, 20, 3

P.T.O.

d) Explain Traveling salesperson problem. Give the recurrence relation to find length of an optimal salesperson tour using Dynamic programming method.

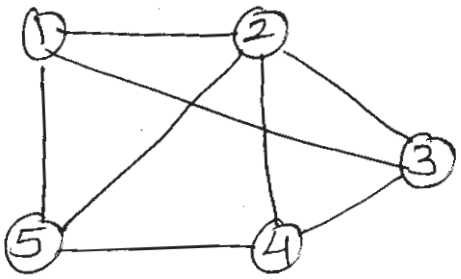
e) Define the following terms :

i) Tree edge ii) Back edge

iii) Forward edge iv) Cross edge

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

a) Find all hamiltonian cycles that are present in following graph.



b) Solve the following instance of 0/1 Knapsack problem using LCBB method.

n = 4 m = 7 P = (5, 5, 6, 8) W = (1, 2, 3, 4).

c) Determine the polynomial of smallest degree that inter polates the points (0, 5), (1, 10) & (2, 21).

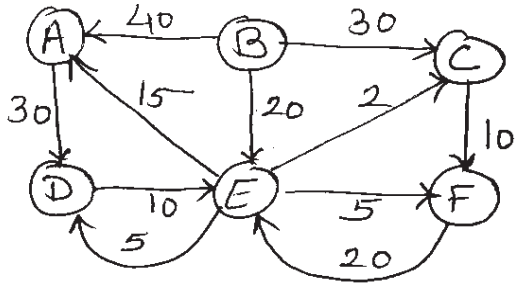
d) Give a nondeterministic algorithm to solve 0/1 Knapsack problem. What is its time complexity.

e) Let A[l...n] be an array of integers, integers can be duplicated. Write an efficient algorithm to find occurences of given integer in an array A. Find its time complexity.

Q4) Attempt <u>any two</u> of the following : **[2 × 8 = 16]**

a) Write an algorithm for quick sort. Obtain the recurrence relation for the running time T(n). Also derive the time complexity.

b) Explain Dijkstra's algorithm to generate single source shortest paths and apply it on the following graph.

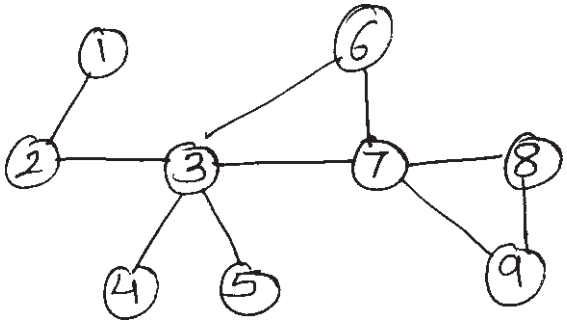


Source vertex is B.

c) Describe matrix chain multiplication problem. What is the best way to multiply a chain of matrices with dimensions that are 20 × 5, 5 × 10, 10 × 15, 15 × 3 and 3 × 7 using dynamic programming method.

Q5) Attempt <u>any two</u> of the following : **[2 × 8 = 16]**

a) What is articulation point. Give rules to identify articulation points. Apply these rules to identify articulation points from the following graph.



Also draw bi connected components.

b) What is sum of subset problem. Let weights given are w = {5, 6, 10, 11, 14, 15} and m = 25. Draw the state space tree for the above problem and find all subsets that sums to 25.

c) Obtain the reduced cost matrix for the TSP instance given by the cost matrix

$$\begin{bmatrix} \infty & 10 & 12 & 9 & 5 \\ 7 & \infty & 6 & 4 & 3 \\ 8 & 4 & \infty & 4 & 8 \\ 11 & 10 & 5 & \infty & 5 \\ 5 & 4 & 9 & 6 & \infty \end{bmatrix}$$

Which node will be selected next in the LCBB formulation of the problem?

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Total No. of Questions : 8]

SEAT No. : ____

P860

[Total No. of Pages : 4

[4139] - 201

M.Sc. (Sem. - II)

COMPUTER SCIENCE

CS - 201 : Digital Image Processing

(2011 Pattern)

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

Instructions to the candidates:

1) ***Questions 1 is compulsory.***
2) ***Attempt any four from the remaining.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***

Q1) Attempt all of the following : **[8 × 2 = 16]**

a) Give reason.

Image negative transformation is suited for enhancing white or gray detail embedded in dark region of an image.

b) Define reflection of a set and translation of a set by point 'z'.

c) State the two basic properties of intensity values on which segmentation algorithms are based.

d) What are the number of bits required to store a digitized image of size M × N with 'K' intensity levels? Also state the number of bits required when M = N.

e) Define 2-D discrete impulse for discrete variables *x* & *y* and its shifting property.

f) Harmonic mean filters work well with what type of noise?

g) State any two methods of generating signatures.

h) What is the difference between an edge and a boundary?

P.T.O.

Q2) a) State the equations for 2-D discrete Fourier transform and its inverse. Describe any two properties of 2-D discrete fourier transform. **[8]**

b) Given below is '*x*': a section of horizontal intensity profile from an image. Illustrate the 1st and 2nd derivative of the 1-D digital function represented by '*x*'. Depict zero-crossing, if any. **[4]**

Scan Line

x :

5	5	5	5	5	2	2	2	2	2	2	3	4	5	5	5	6	6	6	6

c) What is inverse filtering? State the use of inverse filtering. **[4]**

Q3) a) Describe the model of Image Degradation/Restoration process. State the various noise models and typical situations in which they occur.**[8]**

b) Explain the power-law transformation. Why has gamma correction become important as the use of digital images for commerical purpose increased? **[4]**

c) Consider the following two images. **[4]**

$$f_1 = \begin{bmatrix} 4 & 3 & 3 & 1 \\ 2 & 1 & 2 & 1 \\ 3 & 3 & 5 & 1 \\ 1 & 1 & 5 & 5 \end{bmatrix} \qquad f_2 = \begin{bmatrix} 2 & 2 & 2 & 1 \\ 3 & 3 & 1 & 3 \\ 3 & 5 & 5 & 1 \\ 4 & 4 & 4 & 5 \end{bmatrix}$$

Let $a_1 = -1$ & $a_2 = 1$. Prove that median operator is non-linear.

Q4) a) Briefly describe the steps for filtering in the frequency domain **[8]**

b) Give the expressions for thinning and thickening a set A by a structuring element B. **[4]**

c) Consider the following 1-D function 'f' and filter 'w' **[4]**

f : 0 0 1 0 1 0 0 0

w : 1 4 2 2 8

Illustrate the 1-D convolution of 'w' with 'f'

Q5) a) Given a 3-bit image of size 32 × 32 pixels having intensity distribution as shown in the table given below, where intensity levels are in the range 0 – 7 Apply histogram equalization technique & find the transfer function T(r) which relates input image intensity level r_k to output image intensity level s_k. **[8]**

Intensity Level	Number of Pixels
$r_0 = 0$	76
$r_1 = 1$	344
$r_2 = 2$	211
$r_3 = 3$	103
$r_4 = 4$	57
$r_5 = 5$	127
$r_6 = 6$	47
$r_7 = 7$	59

b) What happens if a band - limited function is sampled at a rate that is less than twice its highest frequency? **[4]**

c) Explain the basics of intensity thresholding. **[4]**

Q6) a) Explain the components of a general-purpose image processing system. **[8]**

b) Consider the image segment shown below **[4]**

3	1	2	1(q)
2	2	0	2
1	2	1	1
(p)1	0	1	2

Let V = {1, 2}, compute the lengths of the shortest 4-, 8- & m-path between p & q

c) Write a short note on contrast stretching. **[4]**

Q7) a) Explain the concept in Image sampling & quantization. **[8]**

b) What are the steps in homomorphic filtering? Why are low frequencies of the fourier transform of the logarithm of an image associated with illumination & high frequencies associated with reflectance? **[4]**

c) Describe the fundamental steps performed in edge detection. State the use of magnitude of the first derivative and sign of the second derivative. **[4]**

Q8) a) Explain Erosion & Dilation with the help of diagrams. Show that erosion and dilation are duals of each other. **[8]**

b) Write a short note on ideal low pass filters. **[4]**

c) Define Euclidean distance and city-block distance between pixels p(x, y) & q(s, t). **[4]**

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Total No. of Questions : 5]

SEAT No. : ____

P862

[Total No. of Pages : 4

[4139] - 203
M.Sc. (Sem. - II)
COMPUTER SCIENCE
CS - 203 : Data Mining and Data Warehousing
(2011 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 any eight of the following : **[8 × 2 = 16]**

a) Discuss whether the following is a data mining task.
"Monitoring the heart rate of a patient for abnormalities".

b) What is meant by pattern?

c) What is a concept hierarchy?

d) List various components of a data warehouse.

e) Give an example of classification using prediction.

f) What do you mean by cross-validation?

g) What are the potential applications of data mining?

h) What is a cluster?

i) How do we tokenize text?

j) What is a hub?

Q2) Answer any four of the following : **[4 × 4 = 16]**

a) Explain steps involved in Knowledge Discovery.

b) Explain the OLAP operations in multidimensional data model.

c) What are the issues to be considered during data integration?

d) Define Support and Confidence in Association rule mining. What is the purpose of Apriori algorithm?

e) Explain the preprocessing steps applied to data to improve accuracy, efficiency and scalability of the classification or prediction process.

f) Explain the method that mines the complete set of frequent itemsets without candidate generation.

P.T.O.

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

a) The following table contains training data from weather database containing attributes: outlook, temperature, humidity, windy and Class. Let 'Class' be the class level attribute. Given a data tuple having the values, "rain", "hot", "high" "false" for the attributes outlook, temperature, humidity and windy. Compute a naïve Bayesian classification of the class.

Outlook	Temperature	Humidity	Windy	Class
Sunny	Hot	High	False	N
Sunny	Hot	High	True	N
Overcast	Hot	High	False	P
Rain	Mild	High	False	P
Rain	Cool	Normal	False	P
Rain	Cool	Normal	True	N
Overcast	Cool	Normal	True	P
Sunny	Mild	High	False	N
Sunny	Cool	Normal	False	P
Rain	Mild	Normal	False	P
Sunny	Mild	Normal	True	P
Overcast	Mild	High	True	P
Overcast	Hot	Normal	False	P
Rain	Mild	High	True	N

b) Generate frequent large item sets for the following set of transactions with minimum support = 3.

Transaction ID	Items
T10	M, O, N, K, E, Y
T20	D, O, N, K, E, Y
T30	M, A, K, E
T40	C, A, K, E
T50	C, O, K, E
T60	D, A, Y
T70	B, R, E, A, D

c) The following table shows the terminal and annual exam marks obtained by students in the database. Use the method of least squares to find an equation for the prediction of a student's annual exam marks on the student's terminal exam marks in the course. Predict the annual exam marks of a student who received 78 marks in the terminal exam.

Terminal Exam X	Annual Exam Y	Terminal Exam X	Annual Exam Y
56	34	56	63
53	45	53	90
44	55	56	75
67	89	90	76
41	51	69	74

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

a) What are the different ways to obtain a reliable estimate of classifier accuracy? Explain any one in detail.

b) Why Naïve Bayesian Classification is called naïve? Briefly outline the major ideas of Naïve Bayesian Classification.

c) Differentiate between Agglomerative and Divisive Hierarchical Clustering Algorithm.

d) Discuss the basic measures used for text retrieval.

e) Write a short note on Web Taxonomy.

f) What is the use of Knowledge base? Mention any 5 data mining techniques.

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

a) Name the different attribute selection methods in decision tree induction? Explain any one in detail.

b) Explain dimensional data modeling.

c) Explain and give reasons for over fitting.

d) What are the advantages of having a data warehouse?

e) Construct an FP-Tree for the following data

TID	Item
1	E, A, D, B
2	D, A, C, E, B
3	C, A, B, E
4	B, A, D
5	D
6	D, B
7	A, D, E
8	B, C

f) Draw a decision tree for the following data :

Department	Status	Age	Salary	Count
Sales	Senior	31..35	46K..50K	30
Sales	Junior	26..30	26K..30K	40
Sales	Junior	31..35	31K..35K	40
Systems	Junior	21..25	46K..50K	20
Systems	Senior	31..35	66K..70K	5
Systems	Junior	26..30	46K..50K	3
Systems	Senior	41..45	66K..70K	3
Marketing	Senior	36..40	46K..50K	10
Marketing	Junior	31..35	41K..45K	4
Secretary	Senior	46..50	36K..40K	4
Secretary	Junior	26..30	26K..30K	6

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