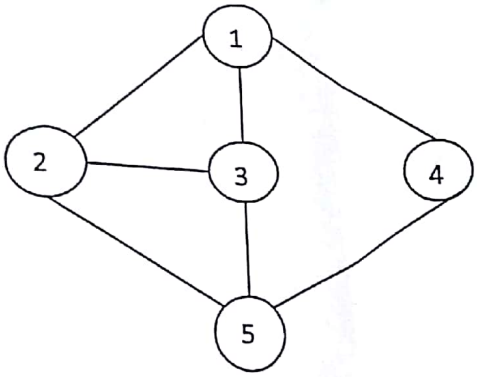
2017CA84

End Semester Examination, December-2018
Department of Computer Science & Engineering,
Motilal Nehru National Institute of Technology Allahabad,
MCA-III Semester

Subject: Analysis of Algorithms **Paper code: CA-3304**
Duration: 3 Hours **Max. Marks: 60**

Note: **Attempt all questions. Make assumptions wherever necessary and quote it.**

Q1. Explain back-tracking, DFS and BFS with help of small example. Differentiate in between backtracking and dynamic programming. Apply the backtracking algorithm to solve the three- colouring problem for the following graph using state space tree. Assume three colours red, green and blue. ***[8 Marks]***



Q2. Explain the optimal sub-structure and overlapping sub-problem with help of example. Consider the following four matrices. Find an optimal parenthesization of a matrix-chain product $A_1 * A_2 * A_3 * A_4$. Give the complexity analysis. ***[8 Marks]***

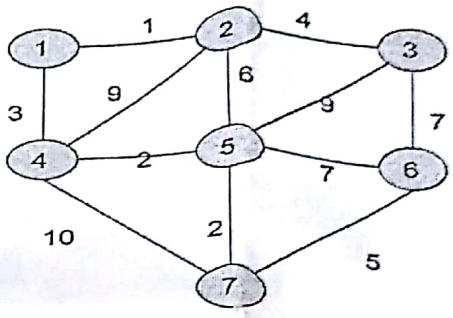
Matrix	*Order*
A_1	*20×30*
A_2	*30×50*
A_3	*50×10*
A_4	*10×5*

Q3. Consider the rod of length and piece of all prices smaller than 7, find the most profitable way of cutting of rod. Give the complexity analysis. ***[6 Marks]***

Length	1	2	3	4	5	6	7
Prices in $	2	6	9	11	18	19	21

Q4. What do you mean by optimal solution in greedy approach? Define the properties and function of greedy approach. Consider the graph G=(V,E) given below. Find the minimum spanning tree by Prim's algorithms. ***[8 Marks]***

P.T.O.



Q5. Is it possible to combine (hybrid) two sorting algorithm for reducing the time and space complexity?, Yes or NO. If yes, what will be the best choices to combine sorting algorithms from available options, explain with valid reason? *[6 Marks]*

Q6. Determine the LCS of X= ATGTAT and Y=ACTACT. *[8 Marks]*

Q7. Give the complete solution (step by step using state space tree) for N- Queen problem using back-tracking with pseudocode. Give the complexity analysis. *[8 Marks]*

OR

Q8. Solve the following

a) Show the comparisons the naive string matcher makes for the pattern P = 0001 in the text T = 000010001010001. *[3 Marks]*

b) Working modulo q = 11, how many spurious hits does the Rabin-Karp matcher encounter in the text T = 3141592653589793 when looking for the pattern P = 26? *[3 Marks]*

c) Compute the prefix function π for the pattern T = ababbabbabbababbabb. *[2 Marks]*

Q9. Write short note on: *[2×4=8 Marks]*

a. Floyd Warshall algorithm.
b. Branch and bound technique.
c. Asymptotic Notations.
d. Divide-N- Conquer *VS* Dynamic Programming.

----------ALL THE BEST----------

Department of Computer Science & Engineering,
Motilal Nehru National Institute of Technology Allahabad,
Mid Semester Examination
September-2018
MCA-III Semester

Subject: Analysis of Algorithms | **Paper code: CA-3304**
Duration: 90 Minutes | **Max. Marks: 20**

Note: **Attempt all questions. Make assumptions wherever necessary and quote it.**

Q1. Consider the array A={26, 17, 41, 14, 21, 30, 47, 10, 16, 19, 21, 28, 38, 7, 12, 14, 20, 35, 39, 3}. Create binary search tree with one more attributes its size of node. Retrieve 17^{th} smallest element in the tree and rank the 12^{th} element. ***[4 Marks]***

Q2. Write down the Radix sort and Merge sort pseudocode and give the complete complexity analysis with help of some example. ***[4 Marks]***

Q3. Solve the following using Master Theorems: ***[1×2=2 Marks]***

(a) $T(n) = 3T\left(\frac{n}{4}\right) + nlogn$

(b) $T(n) = 3T\left(\frac{n}{2}\right) + n$

Q4. Find upper bound for $n^4 + 100n^2 + 50$ ***[1 Marks]***

Q5. Find the complexity of the below function: ***[2 Marks]***

```
function(int n){
 for (int i=0; i<n; i++)
    for(int j=i; j<i*i; j++)
       if(j%i==0){
       for(int k=0; k<j; k++)
          print("*")
   }
}
```

Q6. Prove that the complexity of heap sort is $O(nlogn)$. ***[4 Marks]***

Q7. Construct the Huffman coding tree for the text of characters with given frequencies: ***[3 Marks]***

Characters	***T***	***I***	***V***	***K***	***L***	***E***	***O***	***Z***	***P***	***R***
Frequencies	***43***	***38***	***16***	***8***	***56***	***12***	***41***	***13***	***22***	***6***

Also find the variable length Huffman codes and frequency path length for corresponding above characters.

Department of Computer Science and Engineering
Motilal Nehru National Institute of Technology, Allahabad
MCA III-Sem, End-Sem Exam, December-2018
DBMS (CS 33102)

M.M. 60

Time: Three hours

Note: All questions are compulsory. Assume any missing data and write it at the top of your answer.

Ques 1 Draw an ER diagram that captures the following information. A company database needs to store information about employees (identified by ssn, with salary and phone as attributes), departments (identified by dno, with dname and budget as attributes), and children of employees (with name and age as attributes). Employees work in departments; each department is managed by an employee; a child must be identified uniquely by name when the parent (who is an employee; assume that only one parent works for the company) is known. We are not interested in information about a child once the parent leaves the company? **5**

Ques 2 Consider the following schema: **5*4**
Suppliers(sid, sname, city)
Parts(pid, pname, color)
Catalog(sid, pid, cost)
Write the following queries in Relational Algebra and SQL?

(a) Find the name of suppliers who supply red part.
(b) Find the sids of suppliers who supply red or green part.
(c) Find the sids of suppliers who supply red part or are at Kolkata.
(d) Find pairs of sids such that the supplier with the first sid charges more for some part than the supplier with the second sid.
(e) Find the pids of parts supplied by at least two different suppliers.

Ques 3 In the B+ tree ordered indexing technique, what will be B+ tree for the set of key values: (2, 3, 5, 7, 11, 17, 19, 23, 29, 31). Assume that the tree is initially empty and values are added in ascending order. The number of pointers that will fit in one node are six. **5**

Ques 4 (a) Consider the relational schema: **5+5**
Book (Title, Author, Catalog_no, Publisher, Year, Price)
having following functional dependencies:
I. Title, Author --> Catalog_no
II. Catalog_no --> Title, Author, Publisher, Year
III. Publisher, Title, Year --> Price

What is the Normal Form of the Book relation? Also find its candidate keys and super keys?

(b) Explain with example; dependency preservation and lossless decomposition?

5+5

Ques 5 Consider the following transactions:

T1:
Read(A);
Read(B);
If A=0 then B:=B+1;
Write(B);

T2:
Read(B);
Read(A);
If B=0 then A:=A+1;
Write(A);

The consistency requirement is A=0 or B=0. Take initial values at A=B=0.

(a) Show a concurrent execution of T1 and T2 that produces a non-serializable schedule?

(b) Add lock and unlock instructions to transactions to T1 and T2, so that they observe the two-phase locking protocol?

5+5

Ques 6 **(a)** Draw and explain Database System Architecture?

(b) Explain structured types and inheritance in SQL?

Motilal Nehru National Institute of Technology Allahabad
Department of Computer Science and Engineering
MCA III-Sem, Mid-Sem Exam, September-2018
DBMS (CA 3302)

Time 90 min **M.M. 20**

All questions are compulsory. Assume any missing data and mention it at the top of answer.

Ques 1 A university registrar's office maintains data about the following entities: **4 marks**

(a) **courses**: including number, title, credits, syllabus, and prerequisites,
(b) **course offerings**: including course number, year, semester, section number, instructor(s),timings, and classroom,
(c) **students**: including student-id, name, and program
(d) **instructors**:, including identification number, name, department, and title.

Further, the enrolment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modelled. Construct an E-R diagram for the registrar's office.
Document all assumptions that you make about the mapping constraints.

Ques 2 Consider the relational database below, where primary keys are underlined. Give an expression in relational algebra to express each of the following queries: **10 marks**

Employee(person-name, street,city)
Works(person-name, company-name, salary)
Company(company-name, city)
Manages(person-name, manager-name)

a) Find names of all employees who live in the same city and same street as do their managers.
b) Give all managers in the database a 12% increase in salary.
c) Modify the database so that 'Adam' now lives in 'New Delhi".
d) Find names, street address and cities of residence of all employees who work for "Indian Pvt ltd" and earn more than 20,000 per month.
e) Assume the companies may be located in several cities. Find all companies located in every city in which "Indian Pvt Ltd" is located.

Ques 3 Compute the closure of the following set of functional dependencies for relation schema A= (P,Q,R,S,T). **4+2 marks**

P->QR
RS->T
Q->S
T->P
List the candidate keys for relation A?

Motilal Nehru National Institute of Technology Allahabad
Department of Computer Science & Engineering
End Term Examination 2018-19

Operating Systems (CS 33101), MCA – 3rd Semester

Duration: 3 hours **Max. Marks: 60**

Attempt all questions. Assume if something missing.

1. **(a)** What are the steps performed by an operating system to create a new process? **(3)**
   (b) Consider a logical address space of 64 pages of 1,024 words each, mapped onto a physical memory of 32 frames. **(3)**
   i. How many bits are there in the logical address?
   ii. How many bits are there in the physical address?

2. **(a)** What is Belady's anomaly? Show that a page replacement algorithm that possesses the stack property cannot exhibit Belady's anomaly. **(6)**
   (b) A time-sharing system uses swapping as the fundamental memory management technique. It uses the following lists to govern its actions: a scheduling list, a swapped-out list containing processes that are swapped out, a being swapped-out list containing processes to be swapped out, and a being-swapped-in list containing processes to be swapped in. Explain when and why the time-sharing kernel should put processes in the being-swapped-out and being-swapped-in lists. **(6)**

3. We wish to schedule three processes P1, P2 and P3 on a uniprocessor system. The priorities, CPU time requirements and arrival times of the processes are as shown below.

Process	Priority	CPU time required	Arrival time (hh:mm:ss)
P1	10(highest)	20 sec	00:00:05
P2	9	10 sec	00:00:03
P3	8 (lowest)	15 sec	00:00:00

We have a choice of preemptive or non-preemptive scheduling. In preemptive scheduling, a late-arriving higher priority process can preempt a currently running process with lower priority. In non-preemptive scheduling, a late-arriving higher priority process must wait for the currently executing process to complete before it can be scheduled on the processor. Answer the followings: **(6)**

a. What are the turnaround times (time from arrival till completion) of P2 using preemptive and non-preemptive scheduling respectively.
b. Compute the average waiting time and average throughput of the system using preemptive and non-preemptive scheduling respectively

4. The first known correct software solution to the critical-section problem for two processes was developed by Dekker. The two processes, P0 and P1, share the following variables:

```
boolean flag[2];        /* initially false */
int turn;
do {
flag[i] = TRUE;
while (flag[j]) {
if (turn = = j) {
flag [i] = false;
while (turn = = j)
; // do nothing
flag [i] = TRUE;
}
}
// critical section
turn= j;
flag [i] = FALSE;
// remainder section
} while (TRUE);
```

Figure 1: The structure of process P_i in Dekker's algorithm.

The structure of process P_i (i == 0 or 1) is shown in above Figure 1; the other process is P1 (j == 1 or 0). Prove that the algorithm satisfies all three requirements for the critical-section problem. **(6)**

5. Consider the traffic deadlock depicted in Figure 2 given below: **(6)**

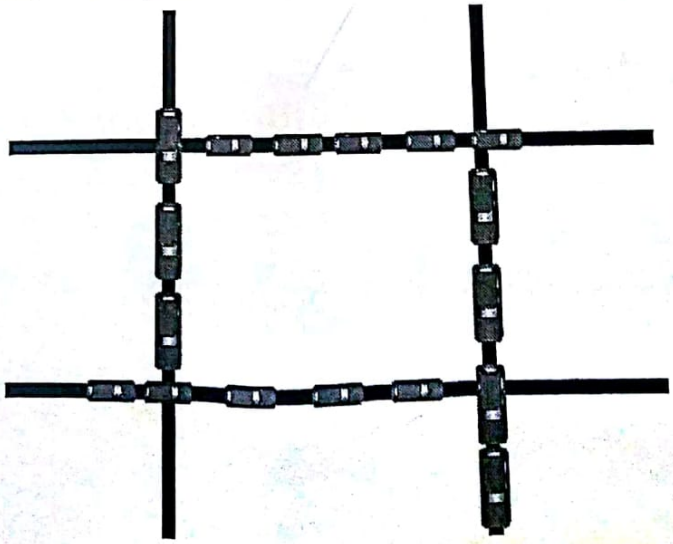


Figure 2: Traffic Deadlock Scenario

a. Show that the four necessary conditions for deadlock hold in this example.
b. State a simple rule for avoiding deadlocks in this system.

6. What kind of hardware support operating system need to implement translation look-aside buffer (TLB)? Describe the inverted page table arrangement to handle the TLB? Is it possible to increase TLB size of a computer by upgrading or updating the OS? **(6)**

7. Consider a system with a two-level paging scheme in which a regular memory access takes 150 nanoseconds, and servicing a page fault takes 8 milliseconds. An average instruction takes 100 nanoseconds of CPU time, and two memory accesses. The TLB hit ratio is 90%, and the page fault rate is one in every 10,000 instructions. What is the effective average instruction execution time? **(6)**

8. Suppose that a disk drive has 5,000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 192, and the previous request was at cylinder 115. The queue of pending requests, in FIFO order, is:
86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130
Starting from the current head position, how many times will the head change its direction to satisfy all the pending requests for each of the following disk-scheduling algorithms? **(6)**
a. SSTF
b. C-SCAN
c. LOOK

9. A simplified view of thread states is Ready, Running, and Blocked, where a thread is either *ready and waiting to be scheduled, is running on the processor, or is blocked (i.e. is waiting for I/0.) This is illustrated in Figure 3.* **(6)**

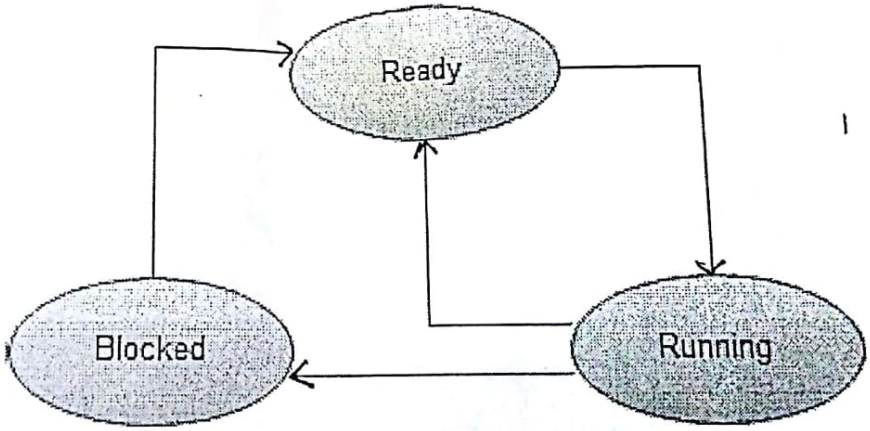


Figure 3: Thread state Diagram

Assuming a thread is in the Running state, answer the following questions: (Be sure to explain your answer.)

a. Will the thread change state if it incurs a page fault? If so, to what new state?
b. Will the thread change state if it generates a TLB miss that is resolved in the page table? If so, to what new state?
c. Will the thread change state if an address reference is resolved in the page table? If so, to what new state?

Department of Computer Science & Engineering,
Motilal Nehru National Institute of Technology Allahabad.

(M.C.A 3rd semester: End-Sem Examination 2018-19)

Subject: Soft Computing (CS33103) Duration: 3.0 HRS Max. Marks: 60

Note: Be specific and to the point in your answers. Make assumptions wherever necessary and quote it. All questions are compulsory and carry equal marks. For numericals, maintain a precision up to 3 decimal places.

Q1. The fuzzy sets A, B, and C are all defined on the universe $X = [0, 5]$ with the following membership functions:

$$\mu_A(x) = \frac{1}{1+5(x-5)^2} \quad :: \quad \mu_B(x) = 2^{-x} \quad :: \quad \mu_C(x) = \frac{2x}{x+5}$$

(i) Sketch the membership functions

(ii) Define the intervals along the x axis corresponding to the λ-cut sets for each of the fuzzy sets A, B, C for the following values of λ: 0.2, 0.6 and 1.0

Q2. Determine the crisp λ-cut relations for $\lambda=0.1\,j$, for $j = 0, 1, \ldots, 10$ for the following fuzzy relation matrix **R:**

$$R = \begin{bmatrix} 0.2 & 0.7 & 0.4 & 1 \\ 1 & 0.9 & 0.5 & 0.1 \\ 0 & 0.8 & 1 & 0.6 \\ 0.2 & 0.5 & 1 & 0.3 \end{bmatrix}$$

Q3. Two fuzzy sets A and B, both defined on X, are as follows:

$\mu(x_i)$	x_1	x_2	x_3	x_4	x_5	x_6
P	0.1	0.7	0.8	1.0	0.7	0.1
Q	1.0	0.9	0.5	0.2	0.1	0

For the fuzzy sets: S1 and S2, find the following:

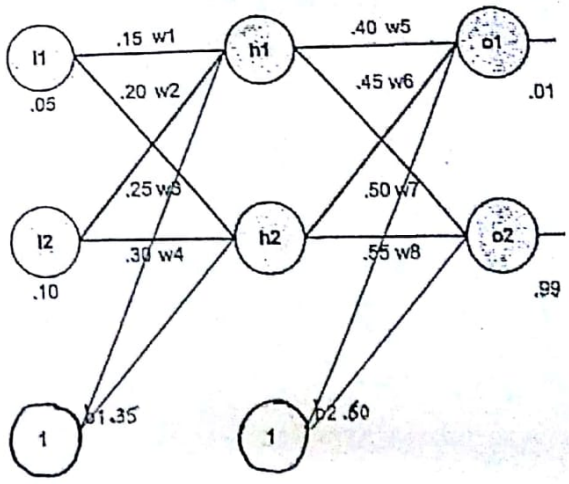
i) $P \cup Q$ *ii)* $P \cap Q$ *iii)* $P - Q$ *iv)* P^c *v)* $(Q^c - P)$ *vi)* $(P \cup Q)^c$ *vii)* $(P^c \cup Q)$ *viii)* $(Q \cap Q^c)$

Q4. As illustrated in figure in the right, input values i1, i2 are given as 0.05 and 0.10 respectively. And target values as 0.01 and 0.99 respectively. Using the back-propagation training algorithm, find:

i) the net output at the end of network.

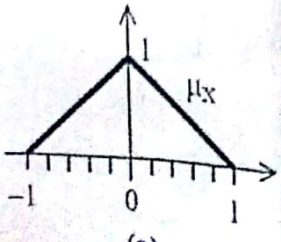
ii) updated weights.

Use learning rate $\alpha = 0.5$ with a binary sigmoidal activation function.

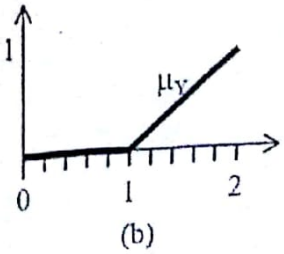


Q5. Using the genetic algorithm, minimize the objective function $f(x) = x^2+x+1$. Assume the necessary operators for the process on your own. Show the work space with *10* population members, each of size *5* bits. $x \in [0,5]$

Q6. Consider a fuzzy system of the form $z = -x - y$, where the fuzzy inputs x and y have membership functions as shown in figures (a) and (b), below. Find the interval *Z* and membership function μ_Z for the fuzzy output *z*.



(a)



(b)