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Enrol. No. .....

END SEMESTER EXAMINATION : April-May, 2023

OPERATING SYSTEM

Time : 3 Hrs. *Maximum Marks : 60*

Note: ***Attempt questions from all sections as directed. Use of Scientific calculator is allowed.***

SECTION – A (24 Marks)

Attempt any **four** *questions out of* **five**.
Each question carries **06** *marks.*

1. (a) How does the distinction between kernel mode and user mode function as a rudimentary form of system protection. (3)

(b) During the life time of a process, it operates in one of the two modes, user mode and supervisor mode. For the following segment of a high-level language program, briefly describe what happens during its execution, as far as interrupt, trap and execution mode are concerned,

P.T.O.

```
int i,j;
...
i = i + 1;
WriteToScreen(i);
ReadFromKeyboard(j);
i=j+1;
```

(3)

2. Describe a mechanism for enforcing memory protection in order to prevent a program from modifying the memory associated with other programs.

3. (a) Explain the possible ways to structure directories. (3)

   (b) What are the various steps taken by operating system to handle page fault? (3)

4. Compare the various memory allocation techniques used by operating system.

5. (a) In a paging scheme, 16-bit address are used with a page size of 512 bytes, if the logical address is 0000010001111101, how many bits are used for the page number and offset ? Compute the page number and offset as well. What will be the physical address, if the frame address corresponding to the computed page number is 15. (3)

(b) Compare the different ways to structure the page table. (3)

SECTION – B (20 Marks)

Attempt any **two** *questions out of* **three.**
Each question carries **10** *marks.*

6. (a) Consider a set of 5 processes whose arrival time, CPU Times needed are given below :

Process	CPU Time	Arrival Time	Priority
P1	10	0	5
P2	5	0	2
P3	3	2	1
P4	20	5	4
P5	2	10	3

Calculate Average Waiting Time and Turn Around Time for Non-premptive SJF, Pre-Emptive Priority and Round Robin (Time Quantum=4) (6)

(b) A system is having 3 user processes P1, P2 and P3 where P1 requires 2 units of resource R, P2 requires 3 units of resource R, P3 requires 4 units of resource R. What is the minimum number of units of R that ensures no deadlock? How deadlock is different from starvation? How deadlock can be prevented? (4)

P.T.O.

7. Suppose that a disk has 100 cylinders, numbered 0 to 99. The drive is currently serving a request at cylinder 40 and the disk arm is moving towards 0. The queue of pending request is : 80, 35, 70, 55, 85, 30, 50, starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending request for FCFS, SSTF, SCAN, C-SCAN, LOOK disk scheduling algorithm? Is disk scheduling, other than FCFS scheduling, useful in a single-user environment?

8. (a) Consider the virtual page reference string 1,2, 3,2, 4, 1, 3, 2, 4, 1. On a demand paged virtual memory system running on a computer system that main memory size of 3 pages frames which are initially empty. Calculate page fault for FIFO, LRU, Optimal Page replacement algorithm. (5)

(b) What are the various ways to transfer data to or from I/O devices? (5)

SECTION – C (16 Marks)

(Compulsory)

9. (a) Suppose you are designing an operating system. Discuss and compare the various free space management techniques could be used to handle free disk space. (5)

CSE202

(b) Consider a system that supports the strategies of contiguous, linked, and indexed allocation. What criteria should be used in deciding which strategy is best utilized for a particular file? (6)

(c) Consider the following snapshot of a system: (5)

	Allocation	Max	Available
	A B C D	A B C D	A B C D
T0	3 1 4 1	6 4 7 3	2 2 2 4
T1	2 1 0 2	4 2 3 2	
T2	2 4 1 3	2 5 3 3	
T3	4 1 1 0	6 3 3 2	
T4	2 2 2 1	5 6 7 5	

Answer the following questions using the banker's algorithm :

(i) Illustrate that the system is in a safe state by demonstrating an order in which the threads may complete.

(ii) If a request from thread T4 arrives for (2, 2, 2, 4), can the request be granted immediately?

P.T.O.

(iii) If a request from thread T2 arrives for (0, 1, 1, 0), can the request be granted immediately?

(iv) If a request from thread T3 arrives for (2, 2, 1, 2), can the request be granted immediately?

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CSIT123 Enrol. No. .....
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END SEMESTER EXAMINATION : APRIL-MAY, 2023

OPERATING SYSTEM CONCEPTS

Time : 3 Hrs. *Maximum Marks : 60*

Note: ***Attempt questions from all sections as directed.***

SECTION – A (24 Marks)

Attempt any **four** *questions out of* **five.**
Each question carries **06** *marks.*

1. Explain the set of services provided by Operating System to the user and the system.

2. What is virtual memory and how is it implemented?

3. (a) Draw the layered architecture of Unix OS and explain the functionality of each layer in UNIX operating system? (2)

   (b) What is ACL (Access Control List) ? Explain types of ACL in Windows . What are file permissions in UNIX OS. (4)

P.T.O.

4. Describe the Indexed and Linked File allocation methods available for allocating disk space to various files.

5. Discuss different methods of communication between cooperating processes

SECTION – B (20 Marks)

Attempt any **two** *questions out of* **three**.

Each question carries **10** *marks.*

6. How many page faults would occur for the following page replacement algorithms, assuming three frames? Remember that all frames are initially empty, so your first unique pages will cost one fault each.

(1) LRU replacement

(2) FIFO replacement

The reference string is as follows:

7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1

7. Explain the following terms -

(i) Deadlock Avoidance

(ii) Deadlock Prevention

(iii) Deadlock Recovery

8. Suppose a file system can have three disk allocation strategies, contiguous, linked, and indexed. We have just read the information for a file from its parent directory. For contiguous and linked allocation, this gives the address of the first block, and for indexed allocation this gives the address of the index block. Now we want to read the 10th data block into the memory.

(1) Explain all file allocation strategies.

(2) How many disk blocks (R) do we have to read for each of the allocation strategies

SECTION – C (16 Marks)

(Compulsory)

9. (a) Consider a system with 80% hit ratio, 50 nano-seconds time to search the associative registers, 750 nano-seconds time to access memory. Find the time to access a page

(a) When the page number is in associative memory.

(b) the time to access a page when it is not in associative memory.

(c) Find the effective memory access time. (8)

(b) Consider a system with four processes Pl, P2, P3 and P4, and two resources, R1 and R2, respectively. Each resource has two instances. Furthermore:

- Pl allocates an instance of R2, and requests an instance of R1;
- P2 allocates an instance of R1, and doesn't need any other resource;
- P3 allocates an instance of R1 and requires an instance of R2;
- P4 allocates an instance of R2, and doesn't need any other resource

Draw resource allocation diagram and check if there is deadlock or not; Also explain how to use resource allocation graph for deadlock avoidance? (8)

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END SEMESTER EXAMINATION : April-May, 2023

OPERATING SYSTEMS-THEORY AND PRACTICES

Time : 3 Hrs. *Maximum Marks : 50*

Note: ***Attempt questions from all sections as directed. Use of Standard Calculator is allowed.***

SECTION – A (20 Marks)

Attempt any **four** *questions out of* **five**.
Each question carries **05** *marks.*

1. "Operating system is resource manager" Justify this statement with suitable functionality of OS.

2. With a neat diagram, explain various states of a process.

3. In what ways resource allocation graphs are used for detection of deadlocks? Write the algorithm.

4. Explain paging scheme of memory management. What hardware support is needed for its implementation?

P.T.O.

5. Name the different file allocation methods. Explain the linked allocation of file implementation with merits and demerits.

SECTION – B (16 Marks)

Attempt any **two** *questions out of* **three.**
Each question carries **08** *marks.*

6. Consider the following page reference string :

1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6.

How many page faults would occur for the following replacement algorithms, assuming frame size of three. Remember that all frames are initially empty, so your first unique pages will all cost one fault each.

- FIFO replacement
- LRU replacement

7. Assume the following workload in a system :

Process	Arrival Time	Burst Time
P1	5	5
P2	4	6
P3	3	7
P4	1	9
P5	2	2
P6	6	3

Draw a Gantt chart illustrating the execution of these jobs using SJF and Round robin scheduling algorithm and also Calculate the average waiting time and average turnaround time.

below the other & filled them with red, green and yellow respectivel

8. (a) Consider a logical address space of 64 pages with 1024 words per page, mapped onto a physical memory of 32 frames.

(i) How many bits are requisrtfred in the logical address?

(ii) How many bits are required in the physical address? (4)

(b) Explain Critical Section problem. Give the conditions that a solution to the critical section problem must satisfy. (4)

SECTION – C (14 Marks)

(Compulsory)

9. (a) Consider a disk with 200 tracks and the queue has random requests from different processes in the order : (6)

55, 58, 39,18, 90, 160, 150, 38, 184

Initially arm is at 100. Find the Average Seek length using FIFO, SSTF, SCAN and C-SCAN algorithm.

(b) Consider the following snapshot of a system:

Processes	Allocation A B C	Max A B C	Available A B C
P_0	1 1 2	4 3 3	2 1 0
P_1	2 1 2	3 2 2	
P_2	4 0 1	9 0 2	
P_3	0 2 0	7 5 3	
P_4	1 1 2	1 1 2	

(i) Calculate the content of the need matrix?

(ii) Determine the total amount of resources of each type? (3)

(c) Explain different types of Threads with benefits of multithreaded programming. (5)

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END SEMESTER EXAMINATION : April-May, 2023

PRINCIPLES OF OPERATING SYSTEMS

Time : 3 Hrs. *Maximum Marks : 60*

Note: ***Attempt questions from all sections as directed.***

SECTION – A (24 Marks)

Attempt any **four** *questions out of* **five**.
Each question carries **06** *marks.*

1. Distinguish between Multiprocessor Systems and Multiuser Systems.

2. What are semaphores? How can semaphores be used to avoid critical section problem?

3. Discuss the usage of following commands: cal, cat(append), cat(concatenate), mv, cp, man, date.

4. Elaborate the concept of paging used in memory mangaement with help of diagrams.

P.T.O.

5. Discuss the preemptive and non-preemptive versions of Shortest Job First scheduling algorithm.

SECTION – B (20 Marks)

Attempt any **two** *questions out of* **three**.

Each question carries **10** *marks.*

6. Compare and contrast File Allocation Methods: Contiguous, Linked and Index Allocation. Also list the most common schemes for defining the logical structure of a directory.

7. Write a Shell Script that accepts a filename as a command line argument and finds out if its a regular file or a directoiy. If its a regular file, then performs various tests to see if it is readable, writeable, executable.

8. Discuss one classical syncronization problem with respect to processes. How it is being handled by an operating system? Give an example to justify your answer.

9. (a) Des
pro

(b) Giv
200
eac
pla
42
ef

(c) C

Process	A
	A
P1	0
P2	1
P3	1
P4	
P5	

SECTION – C (16 Marks)

(Compulsory)

9. (a) Describe the services that an operating system provides to users, processes and other systems. (4)

(b) Given memory partitions of 100KB, 500KB, 200KB, 300KB and 600KB (in order), how would each of the first fit, best-fit, worst-fit algorithm place processes of 212KB, 417KB, 112KB and 426KB(in order). Which algorithm makes the most efficient use of memoty? Explain. (4)

(c) Consider the following snapshot of a system: (8)

Process	Allocated Resources				Maximum Requirement				Available resources			
	A	B	C	D	A	B	C	D	A	B	C	D
P1	0	0	1	2	0	0	1	2	1	5	2	0
P2	1	0	0	0	1	7	5	0				
P3	1	3	5	4	2	3	5	6				
P4	0	6	3	2	0	6	5	2				
P5	0	0	1	4	0	6	5	6				

Answer the following questions using the Banker's algorithm

(i) What is the content of the matrix Need? Is the system in a safe state?

(ii) Would the request be granted in the current state if process P1 requests (0,4,2,0)?

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Enrol. No. .....

END SEMESTER EXAMINATION : April-May, 2023

THEORY OF COMPUTATION

Time : 3 Hrs. *Maximum Marks : 60*

Note: ***Attempt questions from all sections as directed.***

SECTION – A (24 Marks)

Attempt any **four** *questions out of* **five.**
Each question carries **06** *marks.*

1. (a) What do you understand by "Undecidability Problem" in the context of Turing Machines? Explain using suitable examples. (3)

   (b) If $w \in L(G)$ and $|w| = k$, where G is in (i) Chomsky normal form, (ii) Greibach normal form, What can you say about the number of steps in the derivation of w? (3)

2. (a) Elaborate upon the differences between Recursive Set and Recursively enumerable set. Use suitable examples. (3)

   (b) Constract a grammar G which generates all the even integers upto 998. (3)

P.T.O.

3. (a) Design a turing machine to compute the function F(w) = wR, such that w belongs to {0,1}+. (3)

(b) What do you understand by Parsing? How Top-down parsing is different from Bottom-up Parsing? Explain with suitable example. (3)

4. What do you understand by Initial functions for natural numbers? Also throw some light on zero function, projection function and composition function.

5. M = ({q1, q2, q3}, {0, 1}, δ, q1, {q3}) is a non-deterministic finite automata where δ is given by:

δ(q1, 0) = {q2, q3}

δ(q1, 1) = {q1}

δ(q2, 0) = {q1, q2}

δ(q2, 1) = Φ

δ(q3,0) = {q2}

δ(q3, 1) = {q1, q2}

Construct the equivalent deterministic finite automa.

SECTION – B (20 Marks)

Attempt any **two** *questions out of* **three**. *Each question carries* **10** *marks.*

6. (a) What shall be the regular expression for representing the set L of strings in which every 0 is immediately followed by atleast two 1's. Prove that regular expression r = ∧ + 1*(011)*(1*(011 *)* also describes the same set of strings. (5)

(b) What do you
grammar. S
ambiguous :

S -> aB | a

7. (a) Prove that
diagram is
over alpha
and b's,
more a th
a's.

(b) Contract
given gra

S -> aA

C-> abb

8. State and
taken into
expression
correspon

(b) What do you understand by Ambiguity of a given grammar. Show that the given grammar is ambiguous :

S -> aB | ab A -> aAB | a B -> ABb | b (5)

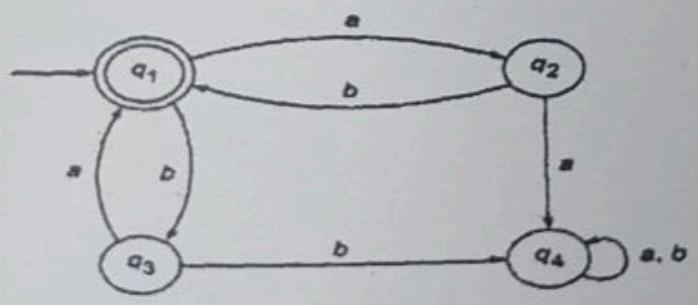
7. (a) Prove that the finite automaton whose transition diagram is given below accepts the set of all strings over alphabet {a, b} with an equal number of a's and b's, such that each prefix has atmost one more a than b's and atmost one more b than the a's. (5)

(b) Contract a reduced equivalent grammar G' to the given grammar G :

S -> aAa A -> Sb | bCC | DaA

C-> abb | DD E -> aC D -> aDA (5)

8. State and prove Arden's theorem that is generally taken into consideration for computing the regular expression. Further Construct a regular expression corresponding to the state diagram described as under :



P.T.O.

SECTION – C

(Compulsory)

(16 Marks)

9. (a) Let x and y be two positive integers represented in unary notation. Construct a turing machine that will halt in final state qy if x >= y and that will halt for non-final state qn if x < y. More precisely, the machine is to perform the computation: q0w(x)0w(y) |- * qyw(x)0w(y): if x>=y q0w(x)0w(y) |- * qnw(x)0w(y): if x<y

(3)

(b) Design a Push Down Automata accepting the set of all even-length palindromes over {a, b} by the empty store.

(4)

(c) Elaborate upon how Chomsky classified the various forms of language using suitable examples. Further discuss the applications of different types of grammar.

(3)

(d) What do mean by PCP and MPCP problem? Explain with the help of suitable examples.

(6)

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END SEMESTER EXAMINATION : April-May, 2023

JAVA PROGRAMMING

Time : 3 Hrs. *Maximum Marks : 60*

Note: ***Attempt questions from all sections as directed.***

SECTION – A (24 Marks)

Attempt any **four** *questions out of* **five**.

Each question carries **06** *marks.*

1. Explain the various features of Java. Why is Java known as platform-neutral language? Explain.

2. Explain the importance of event handling mechanism. What is delegation event model? Explain with examples.

3. What are the various java annotations and its types? Write a program to create custom annotations.

P.T.O.

4. Write a program to explain the difference between abstract classes and final classes.

5. What are the various types of inheritances supported by Java? How is multiple inheritance implemented in Java?

SECTION – B (20 Marks)

Attempt any **two** *questions out of* **three.**
Each question carries **10** *marks.*

6. Explain the life cycle of a thread. Write a program to implement thread priorities.

7. What is maven? Explain the Maven Life cycle in detail.

8. Explain the significance of the following in detail:

   (i) Event Listeners

   (ii) Layout Managers

SECTION – C (16 Marks)

(Compulsory)

9. (a) Write a program to display the creation of threads in two different ways. (8)

(b) Create a class Box in a package Mypackage with its length, breadth and depth. Provide appropriate constructors), which pass value of length, breadth and depth externally to constructor. Provide methods to calculate volume and to display all information of Box. Design different class TestBox class which is not in Mypackage package, and which will contain main function. From this main function, create two Box objects by taking all necessary information. (8)

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END SEMESTER EXAMINATION : April-May, 2023

DISCRETE MATHEMATICAL STRUCTURES

Time : 3 Hrs. *Maximum Marks : 60*

Note: ***Attempt questions from all sections as directed.***

SECTION – A (24 Marks)

Attempt any **four** *questions out of* **five.**

Each question carries **06** *marks.*

1. (a) 75 Children went to a circus, where they can attend a magic show, a comedy show and an animal show. 20 of them attended all three shows and 55 attended at least two of 3 shows. Each show costs Rs. 5 and total money collected is Rs. 700. Find number of children who did not attend any of 3 shows. (3)

(b) Using algebra of proposition show that : (3)

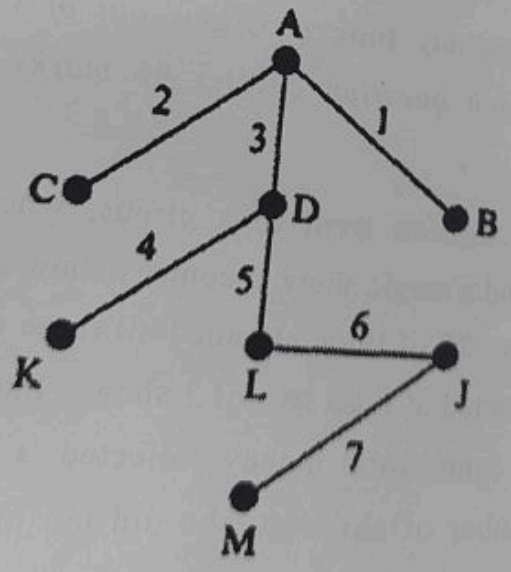
$$(\sim P \rightarrow (\sim P \rightarrow (\sim P \wedge q))) \equiv (P \vee q)$$

P.T.O.

2. (a) A graph contains 21 edges, 3 vertices of degree 4 and all other vertices of degree 2. Find total number of vertices. (3)

(b) Let G be a connected planar graph with p vertices and q edges, where $p \geq 3$. Then, Proof that $q \geq 3p - 6$. (3)

3. Explain the Breadth First Search (BFS) Algorithm and apply it on the graph as shown below.



4. (a) *Simplify the following Boolean Expression by using Algebraic Method :* (3)

$$E = a'b'c' + a'bc' + ab'c' + abc'$$

...Simplify the Boolean Expression by K-m...

...(a, b, c, d) ≡ Σ(0,1,2,3,4,5,6,7,8,9,11...

...Show that four fourth roots of u...

...(1, –1, i, –i) form a group with ... multiplication composition.

(b) Consider the set Q of rational nu... be the operation on Q defined b...

$$a*b = a + b - ab$$

(i) Find 3*4

(ii) Is (Q, *) a semigroup?

(iii) Find the identity eleme...

(iv) Do any of the element... What is it?

CSE208

(b) Simply the Boolean Expression by K-map method.

$E(a, b, c, d) \equiv \Sigma(0,1,2,3,4,5,6,7,8,9,11)$ (3)

5. (a) Show that four fourth roots of unity namely (1, –1, i, –i) form a group with respect to the multiplication composition. (2)

(b) Consider the set Q of rational numbers, and let * be the operation on Q defined by

$$a*b = a + b - ab$$

(i) Find 3*4

(ii) Is (Q, *) a semigroup? Is it commutative?

(iii) Find the identity element for *.

(iv) Do any of the elements in Q have an inverse? What is it? (4)

SECTION – B (20 Marks)

Attempt any **two** *questions out of* **three.**
Each question carries **10** *marks.*

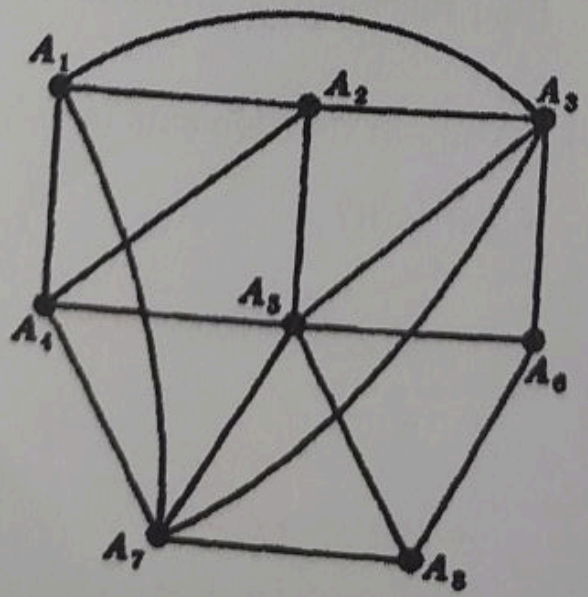
6. (a) Check the validity of following argument. If I try hard and I have a talent then I will become an engineer. If I become an engineer then I will be happy. Therefore, if I will not be happy then I did not try hard or I do not have talent. (5)

(b) Prove following using law of algebra : (5)

(i) $\sim(p \leftrightarrow q) \equiv (p \vee q) \wedge \sim(p \wedge q) \equiv (p \wedge \sim q)(\sim p \wedge q)$

(ii) $\sim(p) \rightarrow (q \rightarrow r) \equiv q \rightarrow (p \vee r)$

7. (a) Write an algorithm by Welch and Powell for a coloring of a graph G. Apply that algorithm on the given graph to find how many colours are needed. (7)



(b) Let R be a relation defined on set of integers such that aRb iff $a \equiv b \pmod m$ where m is an integer. Prove that R is an equivalence relation. Also, find equivalence classes of relation R. (3)

8. (a) Set D_m of divisors of m is a bounded, distributive lattice with $a + b = a \vee b = \text{lcm}(a, b)$ and $a * b = a \wedge b = \gcd(a, b)$. (7)

(i) Show that D_m is a Boolean algebra if m is square free, i.e., if m is a product of distinct primes.

(ii) Find the atoms of D_m.

(b) Find the type of a structure (Z, *) where Z is a set of all integers and a*b=min(a,b). (3)

SECTION – C (16 Marks)

(Compulsory)

9. (a) Consider D_{50} =- {1,2,5,10,25,50} and the relation '/' be defined. Determine the following:

(i) Draw the Hasse Diagram.

(ii) Find all the upper bound and lower bound of

5 and 10.

(iii) Find glb of 5 and 10.

(iv) Determine the greatest and least element of D_{50}.

(v) Find the complement of each element in D_{50}.

(vi) Is D_{50} Distributed? Justify your answer.

(10)

(b) Explain the Warshall Algorithm to compute the transitive closure. And, apply it to find the transitive closure of Relation R={(1,1), (1,3), (2,2), (3,1), (3,2)} on the set A={1,2,3}. (6)

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Time : 3 Hrs.

Note: Attempt

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1. State and

2. Prove th
k compo
edges.

3. Prove th
(n-1) ed

4. Let (A,
and b i

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CSIT206 Enrol. No. .....

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END SEMESTER EXAMINATION : April-May, 2023

DISCRETE MATHEMATICS FOR IT

Time : 3 Hrs. *Maximum Marks : 60*

Note: ***Attempt questions from all sections as directed.***

SECTION – A (24 Marks)

Attempt any **four** *questions out of* **five.**
Each question carries **06** *marks.*

1. State and prove De Morgan's Law.

2. Prove that a simple graph with n vertices and k components can have at most ½ (n-k) (n-k+1) edges.

3. Prove that if G is connected graph with n vertices & (n-1) edges then G is a tree.

4. Let (A, *) be a semi group, further more for every a and b in A, if $a \neq b$, then $a * b \neq b * a$.

P.T.O.

5. Consider the following conditional statement :

If the flood destroy my house or the fires destroy my house, then my insurance company will pay me.

Write the converse, inverse and contrapositive of the statement.

SECTION – B (20 Marks)

Attempt any **two** *questions out of* **three**. *Each question carries* **10** *marks.*

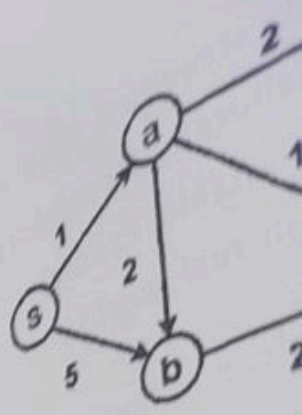
6. Distinguish between Function and Relation with suitable example. Let A = {1,2,3}, B = {p, q} and C = {a, b}.

Let f: A → B is f = {(1, p), (2, p), (3, a)} and

g: B → C is given by {(p, b), (q, b)}.

Find gof and show it pictorially.

7. Using Dijkstra's Algorithm, find the shortest distance from source vertex 'S' to remaining vertices in the following graph –



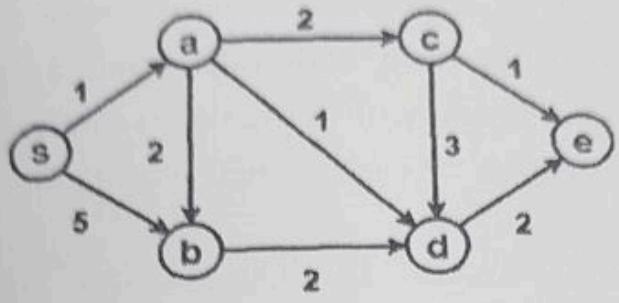
Also, write the order in

8. Explain the role of Pr
codes. Also explain Inv
Principle. Let A = {1
defined by "a divides
pair, draw directed g

SEC
(Co

9. (a) Describe steps
Minimum spanr
algorithm to fin
edges as under

SA = 2, SF = 4
BF = 1, CD =



Also, write the order in which the vertices are visited.

8. Explain the role of Prefix codes and optimal prefix codes. Also explain Invertible functions and Pigeonhole Principle. Let A = {1, 2, 3, 4}, and R is a relation defined by "a divides b". Write R as a set of ordered pair, draw directed graph. Also find R^{-1}.

SECTION – C (16 Marks)

(Compulsory)

9. (a) Describe steps of Prim's algorithm for finding Minimum spanning tree of a graph. Apply the algorithm to find the MST of the graph, details of edges as under.

SA = 2, SF = 4, AF = 1, AB = 5, BC = 3, BD = 2, BF = 1, CD = 3, CT = 1, DE = 3, DT = 2, EF = 2.

(6)

P.T.O.

(b) Describe Algebraic structure with one binary operation. Also elaborate Homomorphism and Isomorphism with suitable example. Write one application of each in real world. (5)

(c) Using Laws of Boolean Algebra, simplify the statement S : $(\neg(P \vee Q) \vee (\neg(P \wedge Q) \wedge Q))$. (5)