

MCA SEM-II

Data Structures

19th May 2009

Con. 2266-09.

(REVISED COURSE)

DD-0148

(3 Hours)

[Total Marks : 100]

- Note:
- Question 1 is compulsory
 - Answer any 4 from the remaining 6 questions
 - All questions carry equal marks

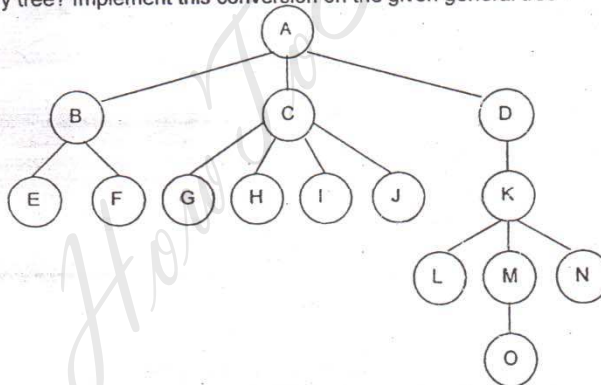
- Q1 a) Write short notes on
- Big-O Notation
 - Circular Linked Lists
 - Depth-First Traversal and Breadth-First Traversal in graphs
- (10)
- b) Given the set of symbols and corresponding frequency table as below, explain the steps to find the Huffman Code

Symbol	A	B	C	D	E	F	G	H	I
Frequency	7	6	4	6	5	1	10	7	3

(10)

- Q2 a) Using mid-square hashing method store the keys given below in an array of size 1000
 224562, 137456, 214562, 140145, 214576, 162145, 144467, 199645, 234534
 Because of the key length square only the first three digits of the key.
 Use pseudorandom number generator for rehashing if collisions occur (Take $a = 3$ and $c = -1$ as factors)
- (10)
- b) Define and explain the stack data structure with a suitable example. Give algorithms for Push, Pop, StackFull and StackEmpty functions.
- (10)

- Q3 a) Give the definition of a general tree. What are the steps to convert a general tree to a binary tree? Implement this conversion on the given general tree



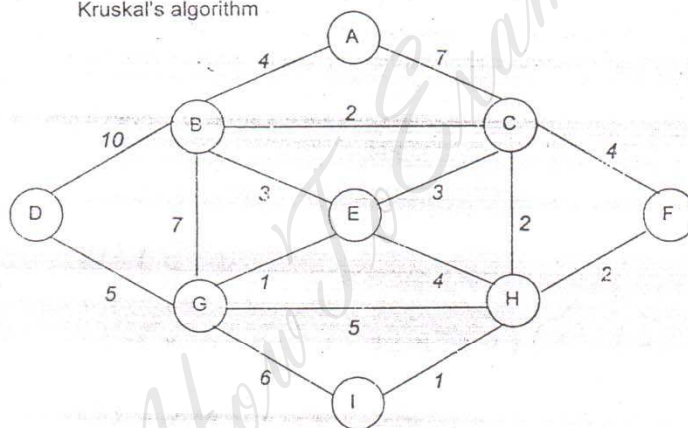
- b) For a singly linked list, write algorithms to
- Count the number of nodes in the list.
 - Append two lists together
- (10)

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Con. 2385-B5-9795-09.

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- Q4 a) Define an AVL Tree. Write an algorithm to Rotate AVL Tree Left and illustrate with the help of an example. (10)
- b) i) Write an algorithm for sorting elements using Shell Sort.
 ii) An array contains the elements
 81, 94, 11, 96, 12, 35, 17, 95, 28, 58, 41, 75, 15
 Show the contents of the array as it goes through Shell Sort (Consider increment factors 5, 3 and 1) (10)
- Q5 a) A binary tree has 10 nodes. The inorder and preorder traversal are shown below.
 Inorder Traversal: A B C E D F J G I H
 Preorder Traversal: J C B A D E F I G H
 Show a step-wise reconstruction of the binary tree along with its postorder traversal (10)
- b) Write the algorithm to
 i) Delete an element in a doubly linked list
 ii) Interchange the nth and mth element of a doubly linked list (10)
- Q6 a) What is queue? Explain the working of a circular queue and give algorithms for inserting an element and deleting an element from the circular queue. (10)
- b) i) Give Dijkstra's algorithm to determine the shortest path in a graph
 ii) Determine the minimum spanning tree of the following graph using Kruskal's algorithm



- Q7 a) Define a B-Tree. Build a B-Tree of order 3 created by inserting the following data arriving in sequence 77, 12, 48, 69, 33, 89, 97, 91, 37, 45, 83. (10)
- b) i) What is a Heap? Give the algorithm for Reheap Down.
 ii) Make a heap out of the following data 23, 7, 92, 6, 12, 14, 40, 44, 20, 21 (10)

V-Ex-I-09-D-Scan-5

MCA SEM-II
Operating System23rd May 2009

Con. 2272-09.

(Revised Course)
(3 Hours)

BB-9204

[Total Marks : 100]

- N.B. :** (1) Question No. 1 is compulsory.
 (2) Attempt any **four** out of remaining **six** questions.
 (3) Assumptions should be made whenever **required** and should be **clearly** stated.
 (4) Answers to questions should be **grouped** and written **together**.
 (5) Draw the **diagrams** whenever **required**.

1. (a) For the processes listed below the table, draw Gantt chart and calculate 12
 Average waiting time and Average turn around time using :—

- (i) FCFS (First come first serve)
 (ii) SJF (Shortest job first) in both conditions preemptive and non-preemptive
 (iii) Round-Robin (quantum = 2)

Processes	Arrival Time(ms)	Burst Time(ms)
P1	0	8
P2	0	4
P3	1	6
P4	2	1

- (b) Describe the differences among short-term, medium-term and long-term 8
 schedulers.
2. (a) Suppose a disk drive has 400 cylinders, numbered 0 to 399. The driver is 12
 currently serving a request at cylinder 120 and previous request was at cyl-
 inder 140. The queue of pending request in FIFO order is :—
 86, 147, 312, 91, 177, 48, 309, 222, 175, 130
 Starting from the current head position, what is the total distance in cylinders
 that the disk arm moves to satisfy all pending request for each of the following
 disk scheduling algorithm ?
 (i) SSTF (ii) SCAN (iii) C-SCAN
- (b) What is process ? Explain about five-state Process model in Process 8
 Management in detail.
3. (a) What is virtual memory ? Explain paging technique in virtual memory. 10
 On a simple paging system with 2^{24} bytes of physical memory, 256 pages
 of logical address space and a page size of 2^{10} bytes, how many bits are in
 logical address ?
- (b) What is thread ? Explain various kinds of threads in detail. 10

[TURN OVER]

4. (a) Consider following snapshot of a system :—

12

Processes	Allocation			Max			Available		
	R1	R2	R3	R1	R2	R3	R1	R2	R3
P0	0	1	0	7	5	3	3	3	2
P1	2	0	0	3	2	2			
P2	3	0	2	9	0	2			
P3	2	1	1	2	2	2			
P4	0	0	2	4	3	3			

Using banker's algorithm answers the following :—

- (i) What is the context of matrix need ?
 - (ii) Is the system in safe state ? Give the sequence.
 - (iii) If a request from process P1 arrives for (1, 0, 2) can the request be granted immediately ?
- (b) Explain the difference between micro kernel and monolithic kernel architectures. Give examples of both type of operating system. 8
5. (a) What is deadlock ? What are the necessary conditions for occurrence of deadlock also mention the methods of handling deadlock ? 10
- (b) Explain direct memory access (DMA) in detail with suitable example. 10
6. (a) Which different types of shells are available in UNIX ? Explain any five salient features of UNIX and also explain the architecture of UNIX. 10
- (b) Discuss different methods of file access and also explain which one is the best access method. 10
7. Write short notes on any four :— 20
- (a) Process Control Block (PCB)
 - (b) Buffering
 - (c) Semaphore
 - (d) Multiprogramming, Multitasking, Multiprocessing
 - (e) Context Switching
 - (f) Monitors.

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MCA SEM-II
Probability and Statistics

26th May 2009

Con. 2276-09.

(REVISED COURSE)

BB-9207

(3 Hours)

[Total Marks : 100]

N.B: (1) Question No. 1 is compulsory.

(2) Attempt any four out of remaining six questions.

(3) Assume any necessary data but justify the same.

(4) Figures to the right indicate marks.

(5) Use of calculator is allowed.

1. (a) (i) Consider 4 computer firms A, B, C and D bidding for a contract. A survey of past bidding success of these firms on similar contract gives following probability of winning. $P(A)=0.35$, $P(B)=0.15$, $P(C)=0.3$, $P(D)=0.2$. Before discussion is made to avail a contract, the firm B withdraws its bid. Find the new probability of winning.

[5]

(ii) Using usual notation notations, find the harmonic mean of Beta Distribution of first kind.

[5]

(b) (i) While calculating coefficient of correlation between two variables x and y from 25 pairs of observation, the following results were obtained.

[5]

$$\sum x^2=650, \sum y^2=460, \sum x=125, \sum y=100, \sum xy=508.$$

It was discovered later that two data pairs were wrongly typed as (6,14) and (9,6) instead of the correct values (8,12) and (6,8). Obtain the correct value of correlation coefficient.

(ii) Let x_1 and x_2 be two stochastic random variables having variance k and 2 respectively. If variance of $Y=3x_1-x_2$ is 25 find k .

[5]

2. (a) The joint distribution function (cumulative) of X and Y is given by [10]

$$F_{XY}(x,y) = 1 - e^{-x} - e^{-y} + e^{-(x+y)}, \quad x \geq 0, y \geq 0$$

$$= 0, \quad \text{otherwise}$$

(i) Find the marginal density functions of X and Y .

(ii) Find $P(X \leq 1 \cap Y \leq 1)$ and $P(X+Y \leq 1)$.

(b) (i) The mean of two samples of size 50 and 100 respectively are 54.1 and 50.3 and standard deviation are 8 and 7. Find the mean and standard deviation of the sample obtained by combining the two samples.

[5]

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(ii) The number of jobs arriving at a computer center between 9am and 10 am is a random variable X with a Poisson distribution with mean 2. The number of jobs arriving between 10 am and 11 am is a random variable Y with Poisson distribution with mean 6. If X and Y are independent, find the probability that more than 5 jobs will arrive between 9 am and 11 am. [5]

3. (a) (i) Of all graduate students in university 70% are women and 30% are men. Suppose that 20% and 25% of the female and male population, respectively, smokes cigarettes. What is the probability that a randomly selected graduate is a woman who smokes? Also find the probability that a randomly selected graduate is a smoker? [5]

(ii) If X and Y are independent R.V.s following $N(8,4)$ and $N(12,48)$ respectively, find the value of λ s.t. [5]

$$P(2X - Y \leq 2\lambda) = P(X + 2Y \geq \lambda)$$

Where X follow normal distribution with parameters μ and σ^2 is given by $X \sim N(\mu, \sigma^2)$.

b(i) A box of 6 IC chips contains 2 defective. A computer center makes a random purchase of 3 of the IC chips. If X is the number of defective chips purchased by the computer center, find the probability distribution of X . [5]

(ii) Calculate the coefficient of variation for the following data: [5]

Daily Wages(Rs)	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	75-80
No. of Workers	17	27	42	61	72	65	47	34	22	13

4. (a) (i) The following are the marks obtained by 8 students in two subjects Computer Graphics (CG) and Probability & Statistics (PS). Calculate rank correlation coefficient. [5]

Marks in CG	15	20	28	12	40	60	20	80
Marks in PS	40	30	50	30	20	10	30	60

(ii) The mean weekly sales of soap bars in independent departmental stores was 146.3 bars per store. After an advertising campaign the mean weekly sales in 22 stores for a typical week increased to 153.7 and showed a standard deviation of 17.2. Was the advertising campaign successful? (Given: The value of t_α at 5% level of significance for 21 degrees of freedom is 1.72) [5]

(b) (i) Assuming steady state probability for the $(M/M/1)$: $(FCFS/\infty/\infty)$ queuing model when there are 'n' customers in the system as $p_n = \left(\frac{\lambda}{\mu}\right)^n \left(1 - \frac{\lambda}{\mu}\right)$, obtain the relation for expected number of customers in the system. Assume that the mean arrival rate (λ) and mean service rate (μ) are constant. [5]

(ii) A person repairing radios finds that the time spent on the radio sets has been exponential distribution with mean 20 minutes. If the radios are repaired in the order in which they come in and their arrival is approximately Poisson with an average rate of 15 for 8-hour day, What is the repairman's expected idle time each day? How many jobs are ahead of the average radio set just brought in? [5]

5. (a) (i) It is believed that the precision of an instrument is no more than 0.16. Write down the null and alternative hypothesis for testing this belief. Carry out the test at 1% level given 11 measurements of the same subject on the instrument: [5]

2.5, 2.3, 2.4, 2.3, 2.5, 2.7, 2.5, 2.6, 2.6, 2.7, 2.5

(Given for 10 degrees of freedom at 1% level of significance, the table value of χ^2 is 23.2)

(ii) Show that the variance Beta distribution of first kind is $\frac{mn}{(m+n)^2(m+n+1)}$, where m and n are parameters of the distribution. [5]

(b) (i) Calculate the Bowley's coefficient of skewness. [5]

x	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50
f	2	5	7	13	21	16	8	3

(ii) The amount of bread in 100's of pounds (x) that a certain bakery is able to sell in a day has the following probability distribution.

$$f(x) = \begin{cases} Ax, & 0 < x < 5 \\ A(10-x), & 5 \leq x < 10 \\ 0, & \text{otherwise} \end{cases}$$

Find the value of A such that f(x) is a pdf. What is the probability that number of pounds of bread that will be sold tomorrow is more than 500 pounds [5]

6. (a) (i) The probability of occurrence of an event A is 0.7, the probability of non-occurrence of B is 0.5 and non occurrence of at least one of A and B is 0.6. Find the probability that at least one of A and B occur. [5]

(ii) Establish the lack of memory property of geometric distribution. [5]

b) (i) Find the value of k so that [5]

$$f(x) = \begin{cases} kx^2(1-x^3), & 0 < x < 1 \\ 0, & \text{otherwise} \end{cases}$$

(ii) If X is a discrete random variable with pmf P(X), then prove that

$$E(aX+b) = aE(X)+b \text{ and } V(X) = a^2V(X),$$

where a and b are constants.

[TURN OVER

[5]

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7. (a) (i) Calculate the mean deviation from mean for the following distribution: [5]

No of colds experienced in 12 months	0	1	2	3	4	5	6	7	8	9
No of persons	15	46	91	162	110	95	82	26	13	2

(ii) Out of 100 jobs received at a computer center, 50 are of class 1, 30 of class 2, and 20 of class 3. A sample of 30 jobs is taken with replacement. Find the probability that the sample will contain ten jobs of each class. [5]

(b) (i) Consider discrete random variables X and Y with the joint pmf as below.

Y \ X	-1	0	1
-2	1/16	1/16	1/16
-1	1/8	1/16	1/8
1	1/8	1/16	1/8
2	1/16	1/16	1/16

Are X and Y independent? Are they un-correlated? [5]

(ii) Calculate the modal marks for the following: [5]

Marks	10-30	30-50	50-70	70-90	90-110	110-130
No of students	4	10	14	12	8	6

611 : G-m.

Con. 2320-09.

MCA SEM -II
Operating System
(OLD)
(2 Hours)

23rd May 2009
BB-9585

[Total Marks : 100

- N.B.** (1) Question No. 1 is compulsory.
(2) Attempt any four from Question Nos. 2 to 7.
(3) Figures to the right indicate marks.
(4) Mixing of sub-questions is not allowed.

1. (a) For the Processes listed in the following table, using First Come First Served, Shortest Job First, Shortest Remaining Time, Round Robin(quantum = 2). 12

Process	Arrival Time	Processing Time
A	0	1
B	1	9
C	2	3
D	3	9

- (i) Draw a chart illustrating their execution.
(ii) Find Turn around time of each process.
(iii) Find Waiting time of each process.
- (b) What is Operating System ? List and briefly define the functions of operating system. 8
2. (a) Differentiate between Fixed partitioning and Dynamic partitioning. 10
(b) What is virtual memory ? Explain in brief translation look aside buffer. 10
3. (a) What is deadlock ? Explain the methods for deadlock prevention. 10
(b) What is Process ? Explain the structure of Process Control Block in brief. 10
4. (a) What is file management system ? List and briefly explain file allocation methods. 10
(b) (i) On simple paging system with page table containing 512 entries of 16 bits (including valid/invalid bit) each, and page size of 1024 bytes. 5
(1) What is the size of logical address space ?
(2) How many bits in the physical address specify page frame number ?
(3) How many bits in the logical address specify the page number ?