

Unique Paper Code : 32341102

Name of the Paper : Computer System Architecture

Name of the Course : **B.Sc. (H) Computer Science**

Semester : I

Duration : 3 Hours

Maximum Marks: 75

***Attempt Any Four Questions  
All Questions Carry Equal Marks.***

Q1. A combinational circuit controls a light bulb using three binary switches. The bulb glows whenever even number of switches is turned ON. Draw truth table for the said combinational circuit and obtain an optimized Boolean expression in Sum Of Products (SOP) and Product Of Sums (POS) forms using Karnaugh Maps. Also draw the logic diagrams for Boolean expressions obtained in both SOP and POS forms.

Q2. Consider the following snapshot of a memory to answer the questions that follow:

Memory	
200	600
.	
.	
.	
400	MODE   OPCODE
401	200
.	
.	
.	
600	30

A two word instruction is stored at location 400 with its address field at location 401. Which addressing mode is being used if the value of operand is 30, 200 and 600 respectively? If the effective address obtained by using indexed register addressing mode is 300. What is the content of index register? If the OPCODE of the instruction is BUN, what would be the value of program counter before and after the execution of the instruction? What would be the value of program counter before and after the execution of the instruction if the OPCODE is ADD? Give the excitation table for a flip flop AB whose characteristic table is given as follows:

A	B	Q(t+1)
0	0	Q'(t)
0	1	0
1	0	1
1	1	Q(t)

Q3. Perform the following operations as directed:

- Convert  $4433_5$  in the given radix to decimal number system and then to binary number system
- $CF6D_{16}$  to octal number system
- Add  $64_8$  and  $35_8$
- Subtract  $7B_{16}$  from  $C4_{16}$  using signed 2's complement form
- Give BCD representation of 5468.

Q4. Specify the number of bytes that can be stored in a  $32M \times 16$  memory. How many address lines and data lines are required for it? How many  $32 \times 8$  chips are required to provide a memory capacity of  $1024 \times 8$ . Show the interconnections required to construct a  $256 \times 8$  ROM from  $128 \times 8$  ROM chips and a decoder.

Identify the type of following I/O interface commands:

- check to see if a printer is ready for printing
- skip to the beginning of a tape
- check for an error during an I/O transfer
- write a block of data onto a magnetic disk.

Q5. A computer uses a memory unit of 256K words of 16 bits each. A binary instruction code is stored in two words of memory. The instruction has four parts: an addressing mode field to specify one of the two addressing modes, an operation code, a register code part to specify one of the 256 registers and an address part. Calculate the number of bits in each part of the instruction and indicate them by drawing the instruction format. Calculate the number of operations that can be supported by the above mentioned instruction format.

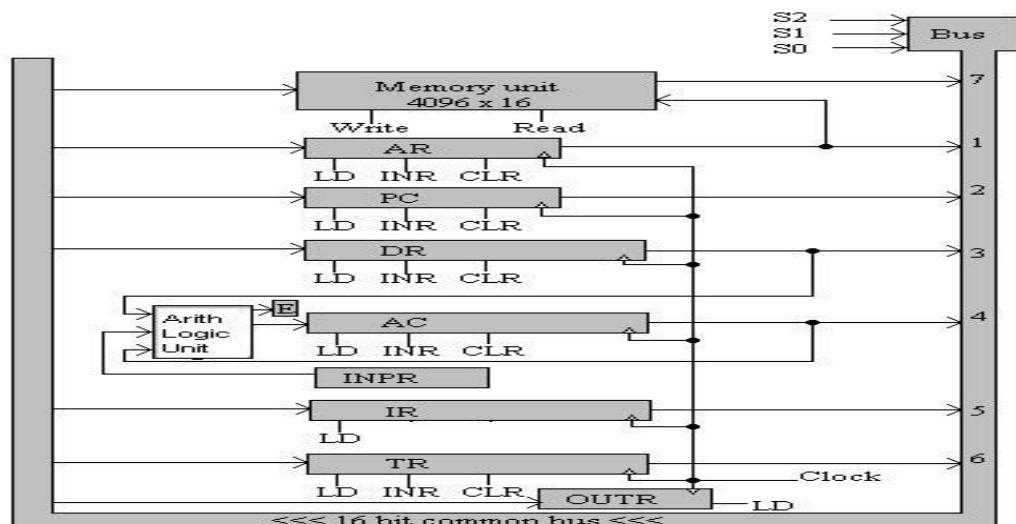


Figure I. The Common Bus System

Consider the common bus system of a basic computer depicted in Figure I. The control inputs given in Table I are active in the common bus system at a time instant  $t_0$ . Give register transfer statements to specify the register transfer that will be executed during the next clock transition  $t_1$ .

	S <sub>2</sub>	S <sub>1</sub>	S <sub>0</sub>	LD of register	Memory	Adder
I.	1	0	1	PC	-	-
II.	1	0	0	DR	Write	-
III.	0	0	0	AC	-	Add
IV.	1	1	1	TR	Read	-
V.	0	1	1	OUTR		-

Table I. Control Inputs active in Common Bus System at time instant  $t_0$

Q6. A non pipe line system takes 30 ns to process a task. The same task can be processed in a four – segment pipe line with a clock cycle of 10ns. Determine the speedup ratio of the pipe line for 100 tasks.

Explain briefly the following microoperations:

- $M[AR] \leftarrow PC, PC \leftarrow AR+1$
- If (FGI = 1) then  $PC \leftarrow AR$
- $E \leftarrow C_{out}$
- If (AC(15) = 1) then  $S \leftarrow 0$
- (IEN)(FGO+FGI):  $R \leftarrow 1$

Using the appropriate operation codes listed in Table II, specify the 14-bit control word that must be applied to the processor to implement each of the following microoperations:  
 $R5 \leftarrow R4 \wedge R1, R3 \leftarrow R2$

OPR Select	Operation
00000	Transfer A
00110	OR A and B
10100	ADD A and B
10110	Complement A
00100	Subtract A – B
01110	AND A and B

Table II. Encoding of ALU operations

Write a program to evaluate the arithmetic statement:  $(A - B) / C + D$  using one address instructions.

Unique Paper Code : 32341102-OC  
Name of the Paper : Computer System Architecture  
Name of Course : B.Sc. Hons. Computer Science  
Semester : I  
Duration of Examination : Three Hours  
Maximum Marks : 75 Marks

(For students admitted in 2015, 2016, 2017 & 2018)

**Instructions for Candidates:**

1. Answer any **FOUR** questions out of **SIX**.
2. All questions carry equal marks.

- Design a combinational circuit with three binary inputs a, b & c and three binary outputs x, y & z. When the binary input has even number of 1's, then the output is one more than the input. When the binary input has odd number of 1's, then the output is one less than the input. The output remains the same if the input is zero.  
Redraw the above designed circuit using NAND gates only.  
Explain the functionality and disadvantage of SR flip-flop.
- A two-word instruction at address 300 and 301 is a "load to AC" instruction with an address field equal to 400. The first word of the instruction specifies the operation code and mode, and the second word specifies the address part. PC has the value 300 for fetching the instruction. The content of processor register R1 is 500, and the content of index register XR is 200. Consider the following memory state:

Address	Memory
300	Load to AC   Mode
301	400
400	425
425	450
499	525
500	550
501	575
600	650
700	725
701	726
702	750
900	925
925	950

The content of R1 is incremented and decremented prior to the execution of the instruction in case of autoincrement and autodecrement respectively. Show the content of AC in case of following addressing mode:

- Indirect
- Relative
- Indexed
- Register
- Autodecrement

What would be the content of R1 after the execution of instruction Autoincrement?

3. The content of AC in hexadecimal is BF43 and the initial value of E is 1. The initial value of PC in hexadecimal is 08F. The three instructions (CIR, SNA & CMA) will execute in the following sequence:

CIR  
SNA  
CMA

Determine the contents of AC, E, PC, AR and IR in hexadecimal after the execution of every instruction. [Hint: The operation code for CIR is 7080, SNA is 7008 & CMA is 7200.]

4. Perform the arithmetic operation  $(-54) - (-35)$  in binary using signed 2's complement representation for the negative numbers.

Perform the following conversions to the indicated bases:

- $(973456)_{10} = (?)_6$
- $(FE123)_{16} = (?)_8$
- $(101110.101)_2 = (?)_{10}$

Give the logic diagram and truth table of a 3-to-8-line decoder using NAND gates only. Include an active low enable input.

5. In a certain scientific computation, it is necessary to perform the arithmetic operation  $(A_i * B_i) + (C_i * D_i)$  with a stream of numbers. Using a diagram of combinational circuit, specify a pipeline configuration to carry out this task. Assuming that there are 6 tasks for the given computation, list the contents of all registers in the pipeline for  $i = 1$  through 6 with the help of a table. Draw a space time diagram for this pipeline.
6. Assuming 5-bit registers that hold signed numbers, show the step-by-step multiplication process using Booth algorithm when numbers  $(-8)$  &  $(-12)$  are multiplied in binary. Also perform the division of 0101010 by 111. (Both the dividend and divisor are fixed-point binary number in signed magnitude representation)

[This question paper contains 3 printed pages.]

Your Roll No. ....

Unique Paper Code : 12365125\_OC

Name of the Paper : Introduction to Operational Research and Linear Programming

Name of the Course : B.Sc. (Hons.) /B.A. (Hons.)

Semester : I

**Duration : 3 Hours.**

**Maximum Marks: 75**

**Instructions for Candidates**

1. Attempt any four questions from Q1 to Q6.
2. All questions carry equal marks.

Q1. Show that the set  $C = \{(x_1, x_2, x_3) : 2x_1 - x_2 + x_3 \leq 4\} \subset \mathbb{R}^3$  is a convex set. Check whether the vectors  $(2, 6, 3)$ ,  $(4, 3, 6)$  and  $(1, 4, 2)$  form a basis of  $\mathbb{R}^3$ ?

Q2. A firm produces three products A, B and C. It uses two types of raw materials I & II. The maximum availability of raw materials I & II is 5000 and 7500 units, respectively. The raw material requirement per unit of products are given below:

Raw material	Requirement per unit of Product		
	A	B	C
I	3	4	5
II	5	3	5

The labour time for each unit of product A is twice as that of product B and three times of product C. The entire labour force of the firm can produce the equivalent of 3000 units. The minimum demand for the three products are 600, 650, and 500 units respectively. The number of units produced must be in ratio 2:3:4. Assuming the profit per unit of A, B, C is 50, 50 and 80 respectively, formulate the problem as a linear programming problem in order to determine the number of units of each product which will maximize the profit. Use the simplex method to obtain the optimal solution.

Q3. Find all possible basic solutions for the following system of linear equations:

$$2x_1 + x_2 - x_3 + 2x_4 = 2$$

$$3x_1 + 2x_2 + x_3 + 6x_4 = 3$$

Classify them as feasible, infeasible, degenerate and non-degenerate.

Q4. Use the dual simplex method to solve the following LPP:

$$\text{Maximize } Z = 3x_1 - 2x_2$$

$$\text{Subject to } x_1 + x_2 \geq 1$$

$$x_1 + x_2 \leq 7$$

$$x_1 + 2x_2 \geq 10$$

$$x_2 \leq 3$$

$$x_1, x_2 \geq 0$$



Q5. Solve the following Linear Programming Problem using Big-M method:

$$\begin{aligned} \text{Maximize } Z &= 3x_1 + 2x_2 + x_3 \\ \text{Subject to } 2x_1 + 5x_2 + x_3 &= 12 \\ &3x_1 + 4x_2 = 11 \\ x_1 \text{ is unrestricted in sign, } x_2, x_3 &\geq 0 \end{aligned}$$

Q6. Consider the following LPP:

$$\begin{aligned} \text{Maximize } Z &= 3x_1 + c_2x_2 + c_3x_3 \\ \text{Subject to } 2x_1 + 3x_2 &\leq 8 \\ &2x_2 + 5x_3 \leq b_2 \\ &3x_1 + 2x_2 + 4x_3 \leq 15 \\ &x_1, x_2, x_3 \geq 0 \end{aligned}$$

Find an optimal solution to the above problem by taking  $c_2=5$ ,  $c_3=4$ , and  $b_2=10$ . Also, find the range within which these three parameters must lie so that the current solution remains feasible as well as optimal.

Unique Paper Code	:	<b>32341303</b>
Name of the Course	:	<b>B.Sc. (H) Computer Science</b>
Name of the Paper	:	<b>Computer Networks</b>
Semester	:	<b>III</b>
Duration	:	<b>3 Hours</b>
Maximum Marks	:	<b>75</b>
Year of Admission	:	<b>2019</b>

**Instructions for Candidates:**

**Attempt any Four out of Six questions.**

**All Questions carry equal marks.**

- Q1** What are the three flow control/Error recovery protocols used for noisy channel? Compare and contrast the Go-Back-N ARQ with Selective Repeat ARQ. Consider that a 1Mbps satellite link connects two ground stations. The altitude of the satellite is 36,504 km and speed of the signal is  $3 \times 10^8$  m/s. Assume that the acknowledgment packets are negligible in size and that there are no errors during communication. What should be the packet size for a channel utilization of 25% for the satellite link using go-back-127 sliding window protocol? Further consider that a message  $M = 1010001101$  needs to be transmitted over this link. Cyclic redundancy check (CRC) with divisor polynomial  $x^5 + x^4 + x^2 + 1$  is used for error detection. What will be the final message transmitted over the link?
- Q2** Explain the circuit switching and packet switching techniques. How is virtual circuit approach different from datagram approach? A message of size 500 bytes has to be sent in a network having bandwidth 10Mbps. Assume that each packet contains a header of 100 bytes and packet switching technique is used. If the message is divided into 5 packets, what would be the transmission delay?
- Q3** What characteristics of the carrier signal are changed to represent the digital signal in each of the following modulation techniques: - ASK, FSK, PSK and QAM? Which of the four digital to analog modulation techniques (ASK, FSK, PSK, QAM) is most susceptible to noise? Defend your answer.  
In a QAM modulation scheme, there are 4 amplitude levels and 16 phase levels and bit rate is 72 Kbps. Calculate the baud rate.

**Q4** The following character encoding is used in a data link protocol:

A: 11010101; B: 10101001; FLAG: 01111110; ESC: 10100011.

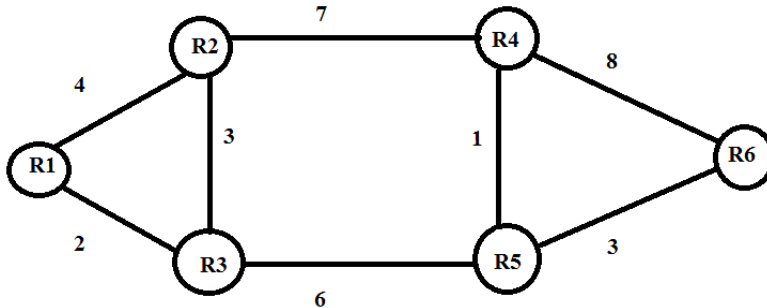
Show the bit sequence transmitted (in binary) for the five character frame. A ESC B ESC FLAG when each of the following framing methods are used:

- i. **Character count**
- ii. **Flag bytes with byte stuffing.**
- iii. **Starting and ending flag bytes, with bit stuffing**

Also find the original data for the given output obtained after applying byte-stuffing technique:

FLAG A B ESC ESC C ESC ESC ESC FLAG ESC FLAG D E FLAG.

**Q5** What is Count to infinity problem? Explain it in brief with suitable example. Consider a network with 6 routers R1 to R6 connected with links having weights as shown in the following diagram.



All the routers use the **distance vector routing algorithm** to update their routing tables. Each router starts with its routing table initialized to contain an entry for each neighbor with the weight of the respective connecting link. After all the routing tables stabilize, how many links in the network will never be used for carrying any data? Also show the distance vector maintained at each router.

**Q6** The network **200.1.2.30** has been subdivided into 4 subnets.

- (i) Which class the given IP address belongs to?
- (ii) Give the subnet mask for the given IP address.
- (iii) Give the IP addresses of these 4 subnets.
- (iv) How many hosts can be on each subnet?
- (v) Determine the starting IP address and the last IP address of each subnet.
- (vi) Determine which network the IP address **200.1.2.130** belongs to.
- (vii) Determine the limited broadcast address for each subnet.

This Question Paper contains 3 page(s)

Unique Paper Code	: 32341302
Name of the Course	: B.Sc. (H) Computer Science CBCS
Name of the Paper	: Operating System
Semester	: III
Duration	: 3 hours
Maximum Marks	: 75
Year of Admission	: 2015-2018

Attempt any four questions. All Questions carry equal marks.

- Q 1. Given memory partitions of 110 KB, 450 KB, 290 KB, 350 KB and 700 KB (in order), how would each of the first-fit, best-fit and worst-fit algorithms place processes of 200 KB, 410 KB, 110 KB and 420 KB (in that order) ? Which algorithm makes the most efficient use of memory?

Consider a paging system with the page table stored in memory. If a memory reference takes 100 nanoseconds how long does a paged memory reference take? If we add a TLB and 70 % of all page-table references are TLB hits, what is the effective memory reference time? (Assume that finding a page-table entry in the TLB takes 10 nanoseconds, if the entry is there.)

Assuming a 2-KB page size, what are the page numbers and offsets for the following address references (provided as decimal numbers): 5378, 15300, and 20500. Show calculation at each step.

- Q 2. Consider a system consisting of four resources of the same type that are shared by three processes, each of which needs at most two resources. Show that the system is deadlock free using resource allocation graph. What is the effect of multithreading on deadlock?

At a particular time of computation the value of a counting semaphore is 10. Then 8 *wait* ( ) operations and 5 *signal* ( ) operations were completed on this semaphore. Determine the resulting value of the semaphore? Show the execution at each step.

A program has just read the fifth record. It next wants to read the eleventh record. How many records must the program read to input the eleventh record using Direct Access and Sequential Access methods? Explain your answer.

- Q 3. Consider the following page-reference string: 3,1,2,4,2,3,1,5,6,2,1,2,3,7,6,3,2,1,2,3  
How many page faults would occur for Optimal and Least recently used replacement algorithms, assuming three and four frames? Note that all frames are initially empty, and first unique pages will all cost one fault each.

Assume we have a demand-paged memory. The page table is held in registers. It takes 10 milliseconds to service a page fault if an empty page is available or the replaced page is not modified and 30 milliseconds if the replaced page is modified. Memory access time is 100 nanoseconds. Assume that the page to be replaced is modified 80 percent of the time. What is the maximum acceptable page-fault rate for an effective access time of no more than 100 nanoseconds?

If the total number of frames in main memory is 120 and there are 4 processes in the system with the demand as 40, 10, 90 and 60 frames, respectively. What will be the number of frames allocated using the equal and proportional allocation strategies?

- Q 4. Consider the following set of processes, with the length of the CPU burst times given in milliseconds:

Processes	Burst Time	Priority	Arrival Time
P1	12	3	0
P2	10	4	1
P3	2	2	2
P4	3	1	3
P5	5	2	4

Draw four Gantt charts illustrating the execution of these processes using FCFS, pre-emptive SJF (equal burst length processes are scheduled in FCFS), a pre-emptive priority (small priority number means high priority, equal priority processes are scheduled in FCFS), and a RR (quantum=3) scheduling.

And calculate average waiting and turnaround time for all above mentioned scheduling algorithms.

Which of the following scheduling algorithms could result in starvation: Shortest-job first, Round robin and Priority. Justify your answer.

- Q 5. Suppose that a disk drive has 3000 cylinders, numbered 0 to 2999. The drive is currently serving a request at cylinder 140, and the previous request was at cylinder 120. The queue of pending requests, in FIFO order, is

500, 1400, 910, 1700, 940, 1509, 1022, 170, 1300

Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, using SSTF, C-LOOK and SCAN disk scheduling algorithms?

What will happen if a user program to get stuck in an infinite loop and never return control to the operating system. Explain how operating system deals with such problem?

- Q 6. Consider the following code fragment executed by a process. What will be the output of this code? Justify your answer.

```
#include <unistd.h >
int main ()
{
    int i ;
    for (i=0; i<8; i++)
        if (i%2 == 0) fork ( ) ;
    return 0 ;
}
```

List three major activities of an operating system with regard to *File Management* and *Memory Management*. Give justification for your answer.

Explain what may happen if setting the values of Base and Limit registers are not privileged instructions? Also why is it easy to add a new service in microkernel approach?

Unique Paper Code : 32341301-OC  
 Name of the Paper : Data Structures  
 Name of the Course : B.Sc. (H) Computer Science  
 Semester : Third (III)  
 Duration of Examination : Three Hours  
 Maximum Marks : 75 marks

Instructions for candidates:  
 Attempt any 4 questions out of 6 questions.

Q1	<p>Write a recursive function 'reverse()' to input a line and print in reverse order. State whether the function is using Tail recursion or non-tail recursion? Show the status of run time stack when 'abcd\n' is given as input in the reverse() function. Convert the reverse() function into non-recursive function using Stack. State whether Stack is a LIFO or a FIFO structure.</p> <p>Following definition of a recursive function is given:</p> $  \begin{aligned}  h(n) &= 0 \text{ if } n=0; \\  &= n \text{ if } n > 4 \\  &= h(2+h(2n)) \text{ if } n \leq 4  \end{aligned}  $ <p>What is the value of h(n) if n = 1?</p>	
Q2	<p>The following list of numbers is given</p> <p>3, 28, 45, 23, 12, 26, 90, 56, 76</p> <p>To search a given number in the above list, which of the searching technique (linear/binary) is best suited. What is the time complexity of the suggested technique? Does hashing the above numbers improve the search efficiency. Draw a hash table with open addressing and a size of 11. Use the hash function "k%11" and linear probing for collision resolution. Insert the above keys into your table (in that order). Show the status of table after each insertion.</p> <p>Sort the above numbers using a divide and conquer algorithm. Specify the algorithm and show each step of the algorithm.</p>	
Q3	<p>If a triangular matrix of n x n dimension is stored as a 1D array, how many elements will be there in 1D array? Suppose the following triangular matrix is given:</p> <pre> 2 0 0 0 3 8 0 0 </pre>	



	<p>4 0 6 0 0 5 2 0</p> <p>Show the elements of the 1D array if the matrix is stored by i) rows ii) columns iii) diagonals (lowest diagonal first) iv) diagonals (highest diagonal first). Write the code of <code>get(int i, int j)</code> function which returns the element stored at <code>i</code>th row and <code>j</code>th column of the given matrix. Give the necessary class definitions. If the matrix is sparse, is it a better idea to use linked lists? Justify.</p>	
Q4	<p>Draw a binary search tree for the following sequence:</p> <p>55, 45, 89, 35, 99, 23, 78, 12, 0, 25, 69, 49</p> <p>Show each step separately. Is it a complete binary tree? Justify. Next, delete the node having value 55. Use delete by merging method. What is the effect on the height of the resulting tree? Write a function to perform the following operations on a binary search tree i) Count the number of leaves ii) Calculate the height of the tree Give the necessary class definitions.</p>	
Q5	<p>Draw the binary search tree corresponding to the following traversals</p> <p>Preorder traversal: JCAEGFMR Inorder traversal: ACEFGJMR</p> <p>Give the post order traversal of the constructed tree. What are the advantages of B-tree over binary search tree? Construct a B tree of order 5 by inserting the following keys:</p> <p>9, 14, 3, 16, 4, 1, 17, 6, 5, 28</p> <p>Show the B tree diagrammatically after each key insertion</p>	
Q6.	<p>Write a template function to insert a new node <code>p</code> into a single linked list before the node <code>q</code> where <code>p</code> and <code>q</code> are the node pointers. The function takes <code>p</code> and <code>q</code> as input. Give the necessary class definitions. Describe the situation in which double linked list has an advantage over single linked list. Does self-organising the list helps in searching? What are the different ways of self-organizing lists? For a given linked list having A, B, C, D as nodes, show the list after each step using Move to Front method. Steps are: i) search D, ii) search D iii) search B iv) search A v) search B vi) search D vii) search A viii) search B</p>	

Unique Paper Code : 32347506

Name of the Course : B. Sc. (Hons.) Computer Science (CBCS)

Name of the Paper : Advanced Data Structures and Algorithms

Semester : V

Duration : 3 Hours

Maximum Marks : 75

Year of Admission : (Admission of 2015, 2016, 2017 & 2018)

Instructions for candidates:

Attempt any four questions.

All questions carry equal marks.

Q1.

a) List the trade off between choosing a binary heap vs a Fibonacci heap to implement priority queue.

b) Suppose we implement `increase_key` function in a min heap using Fibonacci heap as follows:

*increase\_key(node, new\_key)*

1. Increase the *key* of *node* to *new\_key*
2. Concatenate the *child-list* of *node* to *root-list*, update the parent of all children to NULL. Erase the *mark* attribute (if present) of child nodes.
3. Cut the *node* from its parent *z* and insert it to root list. Apply cascading cut to *z* similar to the *decrease\_key()* function of Fibonacci heaps. Reset (erase) the *mark* attribute on *node*.

i) Is this algorithm correct?

ii) What is the amortized cost of this algorithm?

iii) If we add an additional step of consolidating the root list after step 3, would the amortized cost change, explain?

Q2.

a) Suppose a document is composed of six unique characters A-F. Probabilities of occurrence of the characters are given as:

A: 0.45, B: 0.12, C: 0.09, D: 0.13, E:0.16, F=0.05

Compression ratio of a document is defined as the ratio of average code length in Huffman code to average code length in fixed length code. What is the compression ratio achieved by Huffman algorithm for this document?

b) Let  $Z$  be an alphabet. We associate a frequency with each character of  $Z$ . Let  $x, y \in Z$  be two characters having the least frequencies. Show that there exists an optimal prefix code where the codewords of  $x$  and  $y$  have same length and differ only in their rightmost bit.

Q3.

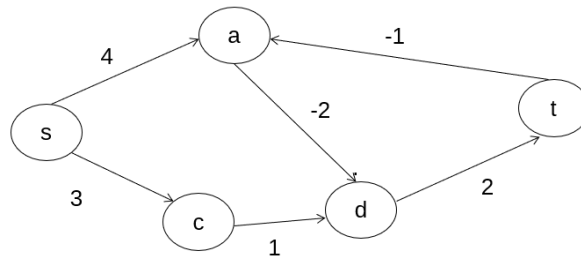
a) Due to ongoing pandemic of covid19, a student will be given a set of  $n$  assignments by her teachers through online mode. The student has the following information in advance for each assignment:

1. Starting time- the time when a teacher will upload an assignment.
2. Ending time- the submission deadline by which student needs to upload her solution.
3. Marks- the marks associated with the assignment.

The duration between the starting and the ending time of an assignment is just sufficient time to work on that assignment alone. Therefore if the student chooses to begin working on one assignment, she can not work on another assignment simultaneously. Moreover partial submissions will fetch zero marks, so she always chooses an assignment that can be completed. The good news is that for every complete submission, she always gets full marks. She has to select a subset of assignments to work on so as to maximize her total marks. A dynamic programming solution to this problem first sorts the assignments in the increasing order of their starting times. Let  $Opt[i]$  denote the optimal marks obtained by considering the first  $i$  assignments in the sorted list of assignments.

- i) Give a recurrence for  $Opt[i]$  when  $i^{\text{th}}$  assignment is included in the selection.
- ii) Give a recurrence for  $Opt[i]$  when  $i^{\text{th}}$  assignment is not included in the selection.
- iii) Give the final recurrence for  $Opt[i]$ .
- iv) Give the base cases for the recurrence.
- v) Derive the time complexity of the approach and explain.

b) Using a dynamic programming approach, identify if there is any negative cycle in the following graph. Show all steps.



Q4.

a) Given a min heap of  $n$  positive integers. Consider the following strategies to find largest integer in this heap.

Strategy 1: Treating the heap as an unordered array, do a sequential search for the largest integer.

Strategy 2: Now consider the following divide and conquer strategy:

```
find_max(root):  
  if root == NULL:  
    return -1  
  l=find_max(root.left)  
  r=find_max(root.right)  
  return(max(l, r, root.key))
```

- i. What is the time complexity of strategy 1?
- ii. Is the strategy 2 correct? Give the recurrence for running time and the solution of recurrence.
- iii. Give an algorithm which makes no more than  $n/2$  comparisons for finding the maximum element in the min-heap? Justify the time complexity of the approach.

b) Write the recurrence relation for time complexity of Karatsuba's algorithm of fast integer multiplication for multiplying two large integers in  $O(n^{1.59})$  time. Using your recurrence compute the number of single digit multiplications for the product  $1552 \times 2374$ . Compare this to the number of single digit multiplications required in basic multiplication method.

Q5.

a) A  $k$ -coloring of a graph  $G = (V, E)$  is a function  $f: V \rightarrow \{1, 2, \dots, k\}$  so that for every edge  $(u, v)$ , we have  $f(u) \neq f(v)$ . The available colors here are named  $1, 2, \dots, k$ , and the function  $f$  represents our choice of a color (or a label) for each node. The  $k$ -coloring problem is defined as follows:

“Given a graph  $G$  and a bound  $k$ , does  $G$  have a  $k$ -coloring?”

- i. What is the lower bound on  $k$  for a complete graph having  $n$  vertices?
- ii. What is the lower bound on  $k$  for a bipartite graph having  $n$  vertices?
- iii. Show that 3-coloring problem is in NP.
- iv. Show that 2-coloring problem is in P.

b) Ankit and Neha have been debating about two optimization problems  $X$  and  $Y$ . Both  $X$  and  $Y$  are known to be in NP. Ankit shows a polynomial time reduction from the set-packing problem to  $X$ , and Neha shows a polynomial time reduction from  $Y$  to vertex cover.

Ankit infers:  $X$  is NP complete while nothing can be said whether  $Y$  is NP complete or not.

Neha infers:  $Y$  is NP complete while nothing can be said whether  $X$  is NP complete or not.

- i. Determine whether Ankit/Neha is/are correct or not. Justify.
- ii. Is  $Y \leq_p X$ ? Justify your claim.
- iii. If we assume that class P = class NP, then which of the following classes do each of  $X$  and  $Y$  belong to: P, NP, NP complete? Justify briefly.

Q6.

Consider the problem of finding the maximum flow in a network graph  $G = (V, E)$ , with capacity  $c_e$  on each edge  $e$ , source vertex  $s$  and sink vertex  $t$ . Let  $f$  be the flow through the graph at  $i$ -th iteration of Ford-Fulkerson's max flow algorithm. Let  $f'$  be the flow in  $i$ -th iteration. Given that initially, the flow is zero which is a valid flow in terms of both capacity and conservation constraints, argue along the following points regarding validity of flow at each iteration. Let the  $s$ - $t$  path selected in  $i$ -th iteration be  $P$ .

a) Show that in following two cases for an arbitrary edge  $e = (u, v)$  on path  $P$ , the capacity constraint is satisfied i.e.  $0 \leq f'(e) \leq c_e$ :

- i) Argue that if  $e = (u, v)$  is a forward edge, the capacity constraint is satisfied.
- ii) Argue that if  $e = (u, v)$  is a backward edge on path  $P$ , the capacity constraint is satisfied.

b) Let  $v$  be a node on  $P$ , argue that in each of following four cases, the conservation constraint is satisfied on  $v$ , i.e.,  $f_{in}(v) = f_{out}(v)$ .

- i) Show that if both  $e$  and  $e_0$  are forward edges, the conservation constraint is satisfied at  $v$ .
- ii) Argue that if both  $e$  and  $e_0$  are backward edges, the conservation constraint is satisfied at  $v$ .

- iii) Show that if  $e$  is a forward edge and  $e_0$  is a backward edge, the conservation constraint is satisfied at  $v$ .
- iv) Argue that if  $e$  is a backward edge and  $e_0$  is a forward edge, the conservation constraint is satisfied at  $v$ .

Unique Paper Code : 32347501  
 Name of Course : B.Sc. Hons. Computer Science  
 Name of the Paper : Systems Programming  
 Semester : V  
 Duration of Examination : 3 Hours  
 Maximum Marks : 75 Marks  
 Students admitted in the year : 2015-2018

**Instructions for Candidates:**

1. Answer any **FOUR** questions.
2. All questions carry equal marks.

1. Assume that three object files b.obj, c.obj and a.obj are given to the Pass I of the linker in the order specified. Consider the following section and symbol tables for the three object files. Construct the combined section table (CST) and public definition table (PDT) generated during Pass I of linking process showing all intermediate steps. Also draw the layout of final executable file generated after Pass II of linking process (show all the intermediate steps in CST).

Name	Size	Align
.branch1	630	8
.branch2	12	4
.branch3	68	16

**Section table for a.obj**

Name	Location	Section-id
P1	39	1

**Symbol table for a.obj**

Name	Size	Align
.branch1	800	8
.branch3	340	16
.branch4	41	4

**Section table for b.obj**

Name	Location	Section-id
P2	28	1
P3	67	3

**Symbol table for b.obj**

Name	Size	Align
.branch3	315	16
.branch4	60	4
.branch5	160	8

**Section table for c.obj**

2. Describe the calling and return sequence between the procedure calls for the following selection sort program on the given input. Also show the division of task between the caller and the callee at each step.

```

void swap(int arr[], int i, int j) {
    int temp = arr[i];
    arr[i] = arr[j];
    arr[j] = temp; }

void selectionSort(int arr[ ], int i, int n) {
    int min = i;
    for (int j = i + 1; j < n; j++) {
        if (arr[j] < arr[min])
            min = j; }
    swap(arr, min, i);
    if (i + 1 < n) {
        selectionSort(arr, i + 1, n); }
    }

void printArray(int arr[ ], int n) {
    //print the sorted array }

main() {
    int arr[ ] = { 9, -8, 4, 42, -5 };
    int n = sizeof(arr) / sizeof(arr[0]);
    selectionSort(arr, 0, n);
    printArray(arr, n); }

```

3. Write a Lex program that checks whether the given name of a URL (Uniform Resource Locator) is in the correct format. The program should also identify the protocol, domain name and path name as well as file name, if any, in the URL.
4. Consider the following grammar with set of non-terminals as  $\{S, P, Q, R\}$  and set of terminals as  $\{=, +, int, (, ), id\}$ .  $S$  is the start symbol.

$$S \rightarrow P = Q$$

$$Q \rightarrow R \mid Q + R$$

$$R \rightarrow P \mid int \mid (Q)$$

$$P \rightarrow id$$

Construct LR (1) set of items and GOTO graph (DFA) for the above grammar. Also, construct LALR parsing table for the above grammar by compacting states formed in LR (1) set of items.

5. Consider the following grammar:

$$\begin{aligned} S &\rightarrow S(E) \mid E \\ E &\rightarrow (S)E \mid 0 \mid 1 \mid \epsilon \end{aligned}$$

Determine five strings of length greater than five that can be parsed by the above grammar and draw the corresponding parse trees. Is the above grammar ambiguous? Justify your answer.

6. Construct a syntax directed definition that generates correct three-address code for C-style *for*-statements and *do-while* statements.



Unique Paper Code : 32341502  
 Name of Course : B.Sc. Hons. Computer Science  
 Name of the Paper : Theory of Computation  
 Semester : V  
 Duration of Examination : 3 Hours  
 Maximum Marks : 75 Marks  
 Students admitted in the year : 2015, 2016, 2017, 2018

**Instructions for Candidates:**

1. Answer any **FOUR** questions.
2. All questions carry equal marks.
3. Assume  $\Sigma = \{a, b\}$  for all the questions unless specified otherwise.

1.	Construct a regular expression and corresponding deterministic finite automaton (DFA) defining a language comprising all strings of length 5 or more such that the letter appearing just before the last is same as the second letter of the string.
2.	Construct a finite automaton (FA) for $FA_1 + FA_2$ , $FA_1.FA_2$ , and $FA_1^*$ . <div style="text-align: center;"> </div>
3.	For languages, $L_1: (aa + ab + ba + bb)^*$ and $L_2: (a + b)^*aa(a + b)^*$ , construct respective DFA's and derive a finite automaton that defines $L_1 \cap L_2$ . Also, construct a regular expression for the resultant DFA.
4.	Prove that the language $L = \{a^n b^{2m} a^{2m} b^n : n \geq 1\}$ is non-regular and construct a Pushdown Automaton (PDA) that accepts $L$ . Trace the working of PDA on the string <b>aabbbbbaaaabb</b> .

5.	<p>Consider the following context free grammar (CFG):</p> $S \rightarrow 0 A 0 \mid 1 B 1 \mid B B$ $A \rightarrow C$ $B \rightarrow S \mid A$ $C \rightarrow S \mid \epsilon$ <p>Eliminate <math>\epsilon</math> – productions, followed by the elimination of unit productions, and then remove all the useless symbols. Also, put the resultant grammar into Chomsky Normal Form (CNF). Here, <math>\epsilon</math> represents the null string.</p>
6.	<p>Considering <math>\Sigma = \{a, b, \triangleright, \sqcup\}</math>, design a Turing Machine (TM) (single tape or multi-tape as you prefer) that transforms <math>\sqcup w \sqcup</math> to <math>\sqcup w w \sqcup</math>. Show the trace of TM on the string <math>\sqcup abb \sqcup</math>.</p>

Unique Paper Code : 32345103  
Code of the Paper : GE-III (Old Course)  
Name of the Paper : Computer Networks and Internet Technologies  
Name of the Course : B.Sc. (H)  
Semester : Semester - I  
Duration of Examination : 3 Hours  
Maximum Marks : 75

Instructions for Candidates:

- i. Attempt any four questions from Question 1 to Question 6.
- ii. Each Question carries equal marks.

1. With the help of an example, differentiate between a URI and URL. Also explain the components of a URL.

Further, discuss the various ways in which CSS code can be incorporated in an HTML document. Provide a CSS code to format the paragraph, body and h1 tags so that they display text with different colors, different fonts and sizes.

2. Compare the characteristics of different types of guided media. Which is the preferred guided media for deployment under the oceans?

Also, write an HTML code to create a part of Periodic Table as given below.

I	II	III	IV	V	VI	VII
H		Periodic Table of Elements				He
Li	Be				B	Ne
Na	Mg				Al	Ar
K	Ca	Sc	Ti	V	Ga	Kr

3. Discuss the role of DNS in the Internet.

Also write a code to create the following form in HTML

## LOGIN FORM

Username:

Password:

City of  
Employment:

Web server:

Please specify  
your role:

Admin

Engineer

Manager

Guest

Single Sign-on  
to the following:

Mail

Payroll

Self-service

4. Explain the layers in which following tasks are performed in the ISO-OSI reference model.
- Physical addressing
  - Logical addressing
  - Routing
  - Session Management
  - Encryption/Decryption

What are frames? Discuss the **Frameset** tag and the **iframe** tag used in HTML to create frames and write HTML code to create the following layout using them.

FRAME 1	FRAME 2
	FRAME 3
	FRAME 4

5. Write short notes on FTP, TELNET and SMTP.

Also write a Javascript code to swap the value of two variables. (Swap means interchange. If a = 10 and b = 20 then after swapping a = 20 and b = 10).

6. Write short notes on different types of network topologies (Bus, Ring, Mesh, Star). Which topology is the best for broadcasting? Justify your answer.

Write a HTML code to create the table below as it is:

<b>Find x using the formula, <math>x = a^2 + b^2 - 4ab</math></b>			Put an Image in this Cell
a	b	x	

Roll No. ....

Unique Paper Code : 32341101-OC  
Name of the Paper : Programming Fundamentals using C++  
Name of the Course : B.Sc(H) Computer Science, DSC-1  
Semester : 1  
Duration : 3 hrs  
Maximum Marks : 75

**Instructions for Candidates**

1. Write your Roll no. on top immediately on receipt of this question paper.
2. Answer any FOUR questions out of SIX given in the question paper.
3. All questions carry equal marks.

1 Write a C++ program/ function/ program segment to do each of the following tasks:

- Write a temperature-conversion program that gives the user the option of converting Fahrenheit (F) to Celsius (C) or Celsius to Fahrenheit where  $F = 9C/5 + 32$ . Then carry out the conversion. Use floating-point numbers. Interaction with the program might look like this:  
Input: -  
Type 1 to convert Fahrenheit to Celsius,  
Type 2 to convert Celsius to Fahrenheit: 1  
Enter temperature in Fahrenheit: 70  
Output: -  
In Celsius that's 21.111111.
- Write a function to generate the given sequence. For example, if  $n=4$  your function should produce output as follows: 1, 2, 2, 3, 3, 3, 4, 4, 4, 4, ...  
You may assume that  $n$  is a positive integer.
- Raising a number  $x$  to a power  $p$  is the same as multiplying  $x$  by itself  $p$  times. Write a function called `power()` that takes a `double` value for  $x$  and an `int` value for  $p$ , and returns the result as a `double` value. Use a default argument of 2 for  $p$ , so that if this argument is omitted, the number  $x$  will be squared. Write a `main()` function that gets values from the user to test this function.

- Given two strings, write a function to check whether two given strings are reverse of each other. For example, "bat" and "tab" are reverse strings of each other.
- 2 Create an **abstract class** called **Vehicle** that defines the characteristics of an object of **Vehicle** class using data members **vehicle\_id**, **engine\_capacity** and **no\_of\_wheels**. The **Vehicle** has a member function **enginecapacity()** also. Further,
- Create a derived class from class **Vehicle** called **FourWheeler** from base **Vehicle** class with data member **no\_of\_seats**.
  - Create two more derived classes **Car** and **Bus** using single inheritance from class **Vehicle**. The derived class **Car** has a member function **enginecapacity()** that displays the **engine\_capacity** in **cubic centimeters**.
  - Use the **FourWheeler** derived class to further create the derived class **Truck** to show multilevel inheritance with data member **loading capacity** in **kgs**.
  - If the access modifiers for **Car**'s data members is set to **private**, which functions/ data members will now become inaccessible?
- 3 Rewrite the following **while** loops using **for** loops and vice versa wherever applicable:

- ```
while( next < limit / 2 ) {
    cout << last << " ";
    long sum = next + last;
    next = last;
    last = sum;
}
```

- ```
int x= 0;
int y = 10
while(x < y)
{
    cout<< x << endl;
    x++;
}
```

- ```
#include <iomanip>
using namespace std;
int main()
```

```

{
    int numb;
    for(numb=1; numb<=10; numb++)
    {
        cout << setw(4) << numb;
        int cube = numb*numb*numb;
        cout << setw(6) << cube << endl;
    }
    return 0;
}

```

- **#include <iostream>**  
**using namespace std;**  
**int main()**  
**{**  
     **int j; //define a loop variable**  
     **for(j=0; j<15; j++)**  
         **cout << j \* j << " ";**  
     **cout << endl;**  
     **return 0;**  
**}**

- Rewrite this code as a call by value: -

```

#include <iostream>
using namespace std;
int x;
int& setx();
int main()
{
    setx() = 92;
    cout << "x=" << x << endl;
    return 0;
}

```

```

int& setx()
{
    return x;
}

```



4 Find error(s)(if any) in each of the following program segments:

- ```
class du{
    private:
        ...;
    public:
        void~du (void);
}
```
- ```
#include <iostream>
#define PI=3.14
int main( )
{
    float r, a;
    cout<<"enter any radius";
    cin>>r;
    a=PI*pow(r,2);
    cout<<"Area="<<a;
    return 0;
}
```
- ```
int base(int x,y)
{
    int z;
    cout<< z;
}
```
- ```
#include
main( )
{
    first = 10, second = 30;
        Jumpto(First; Second);
    Jumpto(Second);
}
```

```
void JumpTo(int N1, int N2 = 20)
{
    N1=N1+N2;
    cout <<N2;
}
```

- ```
#include <iostream.h>
void main()
{
    const int i =20;
    const int * ptr=&i;
    (*ptr)++;
    int j=15;
    ptr =&j;
}
```

5 Given class **Distance** below: -

```
class Distance //English Distance class
{
    private:
    int feet;
    float inches;
    public:
    Distance() : feet(0), inches(0.0)
    { }
    Distance(int ft, float in) : feet(ft), inches(in)
    { }
    void getdist()
    {
        cout << "\nEnter feet: "; cin >> feet;
        cout << "Enter inches: "; cin >> inches;
    }
    void showdist() const
    {
        cout << feet << "'-" << inches << "'";
    }

    Distance operator + (Distance) const;
};
```

Define a **main()** function which creates three objects of class **Distance** and implements the four member functions given below.

- Write a function to overload (**--**) operator (both prefix & postfix),
- Write a function to overload operator (**+**) (to add two distances),
- Write a function to overload operator (**==**) (to check equality of two distances),
- Write a function to overload (**=**) Assignment operator.

- 6 Write a C++ program that calls the functions given below on an array entered by the user in the main function. The program should present a menu to the user and ask for one of the options. The menu should also include options to re-enter array and to quit the program:
- i) Print the even-valued elements
  - ii) Print the odd-valued elements
  - iii) Calculate and print the sum and average of the elements of array
  - iv) Print the maximum and minimum element of array
  - v) Print the array in reverse order.

Note for the typesetter:

1. Please DO NOT Change Courier font to any other font.
2. Please do not change alignment of the text that has been set in courier.

Unique Paper Code : 32347504  
 Name of the Paper : Microprocessor (DSE)  
 Name of Course : B.Sc. (H) Computer Science  
 Semester : V  
 Duration of Examination : Three Hours  
 Maximum Marks : 75 Marks

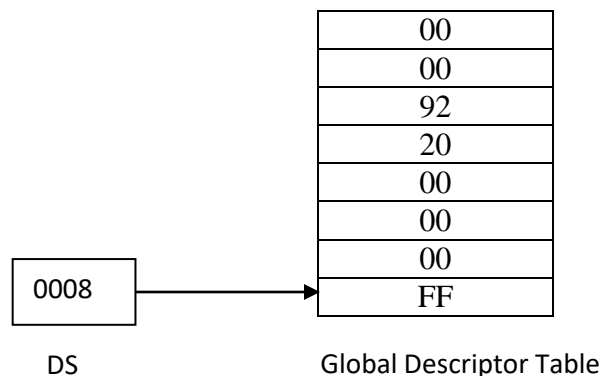
*Attempt any four questions*  
*All questions carry equal marks*

1. How does the real mode memory addressing scheme work? Explain using an example. What is the first and the last address that can be accessed in the Data segment when DS = 0008H?

Given DS = 3200H, BX = 0120H, SI = 0020H, ARRAY = 0015H. Determine the data addressing mode used and the source address accessed by each of the following instructions, considering real mode memory addressing scheme:

- a) MOV AX, [BX+SI+140H]
- b) MOV AX, [34H]
- c) MOV AX, ARRAY[SI+3H]

Explain how the following descriptor stored in the global descriptor table can be used to find the first and last address that can be accessed when DS = 0008H in protected mode memory addressing scheme of 80286. Find the requested privilege level (RPL) and the descriptor privilege level (DPL). Explain the access control provided for this segment, given the value of the access right byte provided in the descriptor.



2. Write the machine language instruction format for the 16 bit instruction mode. Convert the assembly language instruction MOV AX, BX into corresponding machine language form for 16 bit instruction mode. What will be the value of the MOD field in the machine language instruction for MOV BL, [SI+4]?

Given below are some instructions. If the instruction is valid, explain the function performed by it; if not valid, justify.

- a) JMP [4]
  - b) POP CS
  - c) MOV AX, BL
  - d) MOV AX, 'RX'
  - e) MOV [SI], [AX]
  - f) MOV AX, OFFSET DX
3. Differentiate between JMP SI, JMP [SI] and JMP FAR PTR [SI] instructions. How does the CALL instruction differ from the JMP instruction? Explain the working of Near and Far call instructions using an example. Also, show how RET instruction is used to return from a procedure.  
What are the steps followed whenever a software interrupt instruction INT executes? How is it different from a Far CALL?
4. Give the functions of the following pins of 8088 microprocessor:
- a)  $\overline{RD}$
  - b)  $DT/\overline{R}$
  - c) DEN
  - d)  $IO/\overline{M}$

Using a diagram, illustrate the minimum mode 8088 bus timing for a Read operation and show the signals for the pin connections a) to d) given above. Name the pins of 8088 microprocessor which are available in minimum mode but not in maximum mode.

Describe the error correction and detection circuit built using 74LS636 with the help of a diagram.

5. Explain Mode 2 operation of the 82C55 programmable peripheral interface. Which Port is used for this mode and what bit combination in the Command Byte A register is used to select this mode?  
Explain two conditional software interrupt instructions available to the microprocessor. Differentiate between the two hardware interrupt inputs NMI and INTR. Describe the Operation Command Words (OCW) for Programmable Interrupt Controller 8259A. Which OCW should be programmed to read the interrupt request register and what should be the required bit values in the OCW for the same?

6. Describe the improvements brought in by the Pentium Pro microprocessor when compared with the earlier microprocessors. Explain with the help of diagram how dynamic execution architecture of Pentium Pro functions.

Discuss the three software commands used to control the operation of the 8237 DMA controller. How is memory to memory DMA transfer accomplished?

UNIQUE PAPER CODE : 62361101  
NAME OF THE PAPER : Introduction to Operational Research and Linear Programming  
NAME OF COURSE : B.A. (Prog.)  
SEMESTER : I  
DURATION : 3 hours  
MAXIMUM MARKS : 75

INSTRUCTIONS FOR CANDIDATES

*All Questions carry equal marks.*

*Attempt any **four** Questions in all.*

.



1. "Executive at all levels in business and industry come across the problems of making a decision at every stage in their day to day activities. Operational Research provides them with various quantitative techniques for decision making and enhances their ability to make long-range plans and solve everyday problems of running a business and industry greater efficiency, competence and confidence". Comment with examples.
2. A firm is engaged in producing two products A and B. Each unit of product A requires 2 Kgs of raw material and four labor hours of processing, whereas each unit of product B requires 3 Kgs of raw material and three labor hours for the same type. Every week the firm has an availability of 60 Kgs of raw material and 96 labor hours. One unit of product A sold yields Rs 40 and one unit of product B sold gives Rs 35 as profit. Formulate and solve this as a Linear Programming Problem to determine as to how many units of each of the products should be produced per week so that the firm can earn maximum profit.
3. Solve the following linear programming using simplex method

$$\text{Maximize } Z = 3x_1 + 9x_2$$

$$\text{Subject to } x_1 + 4x_2 \leq 8$$

$$x_1 + 2x_2 \leq 4$$

$$x_1, x_2 \geq 0$$

4. For the following LPP, solve for  $(x_1, x_2)$  using Two Phase Simplex Method

$$\text{Minimize } Z = 4x_1 + x_2$$

$$\text{Subject to } 3x_1 + x_2 = 3$$

$$4x_1 + 3x_2 \geq 6$$

$$x_1 + 2x_2 \leq 3$$

$$x_1, x_2 \geq 0$$

5. What is duality in LPP? Give Economic Interpretation of duality. Find the dual of the following linear programming problem

$$\text{Maximize } Z = x_1 + x_2 + x_3$$

$$\text{Subject to } x_1 - 3x_2 + 4x_3 = 5$$

$$x_1 - 2x_2 \leq 3$$

$$2x_2 - x_3 \geq 4$$

$$x_1, x_2 \geq 0, x_3 \text{ unrestricted}$$

6. What is meant by 'Sensitivity Analysis' in Linear Programming Problem? Consider the LPP

$$\text{Maximize } Z = 5x_1 + 12x_2 + 4x_3$$

$$\text{Subject to } x_1 + 2x_2 + x_3 \leq 5$$

$$2x_1 - x_2 + 3x_3 = 2$$

$$x_1, x_2, x_3 \geq 0$$

Solve the LPP and Discuss the effect of changing the requirement vector  $[5, 2]^T$  to  $[7, 2]^T$  on the optimum solution. (Where T indicates transpose of a vector). Which resource should be decreased and by how much to achieve the best marginal increase in the value of the objective function?

Unique paper Code : 62373904\_OC  
Name of the Paper : Data Analysis using Spreadsheet ( SE-1)  
Name of the Course : B.A.(Programme)  
Semester : III  
Duration : 2 Hours  
Maximum Marks : 50

**Instructions for Candidates**

1. Attempt any FOUR questions.
2. Each question carries 12.5 marks each

1. Differentiate between Histogram and bar diagram. Discuss an ogive and give its advantages. Why standard deviation is most widely used as a measure of variation. Describe the steps to calculate cumulative frequency distribution.
2. State advantages of stem and leaf presentation with example in a spreadsheet.
3. How can you use scatter diagram to obtain an idea of the extent and nature of the correlation coefficient.
4. Define Regression. Explain the regression of Y on X and X on Y. At what point do the two regression lines intersect?
5. A group of 25 individuals have been surveyed on the number of hours devoted each day to sleeping and watching TV. The responses are given in the following table:

<b>No. of sleeping hours (x)</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
<b>No. of hours of watching TV (y)</b>	<b>4</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>1</b>
<b>Absolute frequencies (f<sub>i</sub>)</b>	<b>3</b>	<b>4</b>	<b>10</b>	<b>7</b>	<b>1</b>

Calculate the correlation coefficient. Determine the equation of the regression line of y on x. If a person sleeps eight hours, then determine the expected number of hours of watching TV.

6. Explain the step of creating boxplot and pie chart in spreadsheet. What is standard error of regression? How do you determine the goodness of regression? Explain the process of running a regression in a excel spreadsheet.

**Unique Paper Code: 42344304**

**Name of the Course: B.Sc. Physical Science/Mathematical Science**

**Name of Paper: Operating Systems**

**Semester: III**

**Duration: 3 Hours**

**Maximum Marks: 75**

**Year of Admission: 2019**

**Attempt any four out of six questions. All questions carry equal marks.**

Q1. What are the various difficulties that a user can face while interacting with a computer system, which is without an operating system? Differentiate between the two types of user interfaces provided by the operating system. What are the advantages of dual mode operations of operating system? Explain the problems that may arise due to the lack of a hardware-support of dual mode in an operating system.

Q2. Consider a set of 5 processes, with the length of the CPU-burst time given in milliseconds. The processes are assumed to have arrived in the order P1, P2, P3, P4, P5, all at time 0.

Process	Burst Time	Priority
P1	5	2
P2	13	3
P3	8	1
P4	4	5
P5	10	1

- Explain the life cycle experienced by process P3 in terms of process states.
- Briefly explain the various schedulers the process P3 would encounter at each stage.
- Draw four Gantt charts illustrating the execution of the above processes using FCFS, SJF, a non-preemptive priority (a smaller priority number implies a higher priority), and RR (quantum = 1) scheduling.
- What is the turnaround time waiting time and average waiting time of each process for each of the scheduling algorithms in part a?

Q3. What are system calls? Why would an application programmer prefer programming according to a library API rather than invoking actual system calls? Explain briefly how operating system handles a system call. What are the general methods used to pass parameters to the operating system?

Q4. Explain briefly paging memory management scheme. Consider user program (executing under paging memory) of logical address of size 6 pages and page size is 4 bytes. The physical address contains 300 frames. The user program consists of 22 instructions a, b, c, . . . u, v. Each instruction takes 1 byte. Assume at that time the free frames are 7, 26, 52, 20, 55, 6, 18, 21, 70, and 90. Find the following?

- Draw the logical and physical maps and page tables?
- Allocate each page in the corresponding frame?
- Find the physical addresses for the instructions m, d, v, r?
- Calculate the fragmentation if exist?

Q5. What is a shell? Write a Shell Script to find the largest among the 3 given numbers using 'nested if' commands. Write the commands that does the following actions:

- to know the shell that is running on your system.
- to get a one-line manual page descriptions.
- to print second, fifth and seventh character from each line of the file F1
- to print only duplicate lines in a file F1.
- to convert from lower case to upper case

Q6. Explain the following:

- Virtual address space
- Address binding
- Translation look aside buffers
- Dynamic Loading

Consider six memory partitions of size 200 KB, 400 KB, 600 KB, 500 KB, 300 KB and 250 KB. These partitions need to be allocated to four processes of sizes 357 KB, 210 KB, 468 KB and 491 KB in that order. Perform the allocation of processes using First Fit, Best Fit and Worst Fit Algorithm.

**Unique Paper Code** : 42347902  
**Name of Course** : B.Sc Prog. Computer Science/ B.Sc Mathematical Science  
**Name of the Paper** : Analysis of Algorithms and Data structures  
**Semester** : V  
**Year of Admission** : Upto 2018

**Duration: 3 Hours**

**Maximum Marks: 75**

**Instructions for Candidates:**

1. Answer any **FOUR** questions.
2. All questions carry equal marks.

1. Which data structure would you choose for the following tasks and Why? Justify your answer in each of the following case: Case 1: to implement undo/redo operation in a text editor; Case 2: bookmarks tab of a web-browser; Case 3: you need to get out of a maze (without using recursion), for which you are required to store the path that you are currently exploring and be able to go back one step in case of a dead-end and then explore a new possibility from there; Case 4: to store two sorted lists of strings and support their merging into one, in-place (i.e., without creating a copy of the lists); Case 5: write a software for a call center, in which whenever a client calls, his call record should be stored if there is no free operator to pick it up; Case 6: to store the stations of a public transportation line in which new stations can be added at both ends of the line but not between existing stations. Transportation line can be traversed in both the directions; Case 7: create table of contents, i.e., index page of a book. It must show every chapter, its sections and corresponding sub-sections, to all levels.
2. Given a binary search tree and the following pseudocode to traverse the tree. Determine in what order is the function traversing the tree? Modify it to count the number of nodes in the tree.

```
fun traverse(Node t)
    if t==NULL
        return
    else
        traverse(right child of t)
        print(value of t)
        traverse(left child of t)
```

Also, determine which of the following statements is/are false about tree traversals? Justify your answer.

- a. If values 1,2,3,4,5,6 are inserted in the given order in a Binary search tree, then in-order, pre-order and level-by-level traversal are all same.
- b. If values 6,5,4,3,2,1 are inserted in the given order in a Binary search tree, then in-order and pre-order traversal are same.
- c. If values 6,5,4,3,2,1 are inserted in the given order in a Binary search tree, then pre-order and level-by-level traversal are same.

- d. If values 6,5,4,3,2,1 are inserted in the given order in a Binary search tree, then in-order and post-order traversal are same.
3. We want to sort an array of 1000 integers, in which every element is in its correct place except 10 elements. Arrange the following sorting techniques in decreasing order of preference for sorting: Insertion, Quick, Merge, Count. Justify your preference with suitable arguments. Suppose the condition now reverses, i.e., only 10 elements are in their correct place. Specify the order of preference again with justifications.
4. Consider the following modification in (binary) search algorithm on an array  $A[1 \dots n]$ , sorted in increasing order. The array is divided into three equal parts. Instead of finding one middle index, we find two middle indices,  $mid_1$  and  $mid_2$ . If element at  $mid_1$  or  $mid_2$  equals the element 'x' that we are trying to search, we stop. Else, we do either of the following: search x from  $A[1 \dots mid_1 - 1]$  if x is less than element at  $mid_1$  or search x from  $A[mid_1 + 1 \dots mid_2 - 1]$  if x is greater than element at  $mid_1$  but less than element at  $mid_2$  or search x from  $A[mid_2 + 1 \dots n]$  if element at  $mid_2$  is less than x. Write an iterative algorithm for the above mentioned search strategy. What should be the running time of the algorithm? Also, write the recursive version of the algorithm.
5. What value should be chosen as pivot in the following array so that when we apply quick sort to it, the first call to partition should belong to worst-case scenario?  
-5,-3,1,4,2,-6,1,5  
Justify your answer. Also, show steps in partitioning the array around the chosen pivot. Can you use Count sort to sort the above array? If yes, modify the algorithm to do so. If no, justify your answer by giving suitable arguments.
6. Write algorithms to implement the following operations on a circular doubly linked list:
- Search for an element x in the linked list.
  - Using the function implemented in part (i) above, insert an element x after an element y in the linked list.
  - Using the function implemented in part (i) above, replace an element x with an element y in the linked list.
  - Remove  $i^{\text{th}}$  element from the linked list.

Using the algorithms above, perform the following functions. Also, specify which algorithms (out of above mentioned) along with their parameters, would you use for performing the tasks mentioned below.

Insert every character of the word "ALGORITHMS AND DATA STRUCTURES" as a node in an initially empty list. Now, scan the list and replace ' ' (space) character with a '#'. Change the case of value of every alternate node, i.e., AlGoRiTHeMs and so on. Delete  $i^{\text{th}}$  node of the list where  $i = (\text{length of list}) \% 10$  from back. Print the final list.

Unique Paper Code : 62353325\_OC  
 Name of the Paper : SEC : Latex and HTML  
 Name of the Course : B. A. (Prog.) (CBCS)  
 Semester : III  
 Time : 2 Hrs  
 Maximum Marks : 38

*Attempt any four questions. All questions carry equal marks.*

1. Write codes in Latex to draw a circle with shaded sector. Also label its radius.

Write codes in Latex to create a beamer presentation on the Pythagorean Theorem (with at least three slides). Be sure to include diagrams of right triangles.

Write codes in HTML to create a web page showcasing some of your mathematical interests (at least three interests). Make one of your interests in the list a **hyperlink**.

2. Write codes in Latex to typeset the following

$$\frac{\frac{a^2}{b^2} - \frac{ab}{cd}}{\frac{4}{ab^2} - \frac{3}{c^{-1}d}} = \frac{ab - 2cd}{\frac{6 + 4ac}{b^2d}}$$

Write codes in Latex to typeset the following

$$\begin{bmatrix} \sin \theta & \cos \theta \\ \cos^{-1} \theta & \sec^{-1} \theta \end{bmatrix}$$

Write codes in HTML to create a web page with a numbered list displaying titles of three papers (having different colors) of your curriculum.

3. Write codes in Latex to typeset the following

$$\int_{-\infty}^{\infty} e^{x^2} dx = \sqrt{\pi} \text{ and } \sin \alpha \pm \sin \beta = 2 \sin \frac{1}{2}(\alpha \pm \beta) \cos \frac{1}{2}(\alpha \mp \beta).$$

Write codes in Latex to draw a square and an equilateral triangle using **PSTricks** and mark their vertices.

Write codes in Latex to create a beamer presentation on the circumference of a circle (with at least three slides), with first slide being the title slide. Use Latex's picture environment to draw the image of a circle on the second slide while labelling its circumference.

4. Write codes in Latex to plot the functions  $\sin x$  and  $\sin 3x$  over  $-2\pi \leq x \leq 2\pi$ . Show the function  $\sin x$  as a solid curve and  $\sin 3x$  as a dotted curves.

Write codes in HTML to create a web page containing a numbered list of five universities. One of the universities in the list should have big font size.

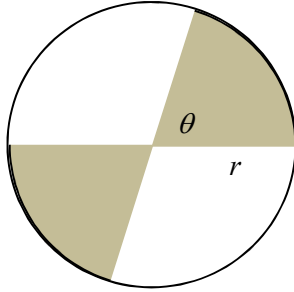
Write codes in Latex to create a beamer presentation of at least three slides on Prime numbers.



5. Write codes in Latex for the following

$$(1+x)^n = 1 + \frac{nx}{1!} + \frac{n(n-1)x^2}{2!} + \dots$$

Write codes in Latex to draw the following



Write codes in Latex to create a beamer presentation of (at least three slides) on a mathematical topic of your choice excluding the Pythagorean Theorem and Prime numbers. Also include diagrams.

6. Write codes in Latex for the following

$$\begin{aligned}x_{2^n} &= 1 + \frac{1}{2} + \left(\frac{1}{3} + \frac{1}{4}\right) + \dots + \left(\frac{1}{2^{n-1}} + \dots + \frac{1}{2^n}\right) \\ &> 1 + \frac{1}{2} + \left(\frac{1}{4} + \frac{1}{4}\right) + \dots + \left(\frac{1}{2^n} + \dots + \frac{1}{2^n}\right) \\ &= 1 + \frac{1}{2} + \frac{1}{2} + \dots + \frac{1}{2} \\ &= 1 + \frac{n}{2}.\end{aligned}$$

Write codes in Latex for the following

$$f(x) = a_0 + \sum_{n=1}^{\infty} \left( a_n \cos \frac{n\pi x}{L} + b_n \sin \frac{n\pi x}{L} \right).$$

Choose a theorem or a problem and write codes in HTML to create a web page showing its proof or solution.

Sr. No. of Question Paper :

Your Roll No.....

Unique Paper Code : 62363324 (OC)

Name of the Paper : Operation Research Application (OR: SEC)

Name of the Course : B.A.(Programme) (admissions before 2019)

Semester : III

Duration : 3 Hours

Maximum Marks: 75

**Instruction for Candidates**

1. Attempt any four questions
2. All questions carry equal marks
3. Show your working clearly in your answer

- The Megacity Power Company wishes to schedule its work force for the coming month. Employees work in an 8-hour shift beginning at 8 a.m., 12 p.m., 4 p.m., 8 p.m. and 12 a.m. All but the late shift (12 a.m. to 8 a.m.) overlap the next shift by 4 hours. Based on past experience, the following number of workers will be needed during the time shown:

Hours	Workers required
12 a.m. – 8 a.m.	6
8 a.m. – 12 p.m.	10
12 p.m. – 4 p.m.	16
4 p.m. – 8 p.m.	18
8 p.m. – 12 a.m.	8

How many workers should be scheduled to report for each of the five shifts if the company wishes to minimize its total work force? Formulate and solve this problem as a linear programming problem.

- Define media and its different types. What is the difference between traditional and online media? What role do media play in our daily life?
- Ram is planning to produce at least 2000 widgets on three machines. The minimum lot size on any machine is 500 widgets. The following table gives the pertinent data of the situation:

Machine	Cost	Production cost/unit	Capacity(units)
1	250	5	500
2	145	10	600
3	175	8	1000

Formulate the problem as an integer programming problem, and find the optimum solution.

- A truck can carry 20 tons of loads. Four types of products are to be loaded. Their per unit weights in tons and values in thousand of rupees are given below:

Type	Weights	Value/unit
A	1	20
B	2	30
C	3	50
D	4	85

At least one unit of each type of load is to be shifted. Determine the loading which will maximize the value of the load.

5. A transport company has trucks available at four different localities A, B, C and D; the number of trucks at these localities is 5,10,7 and 3 respectively. The three stores at destinations P, Q and R require 5, 8 and 10 trucks respectively. Variable costs (hundred of rupees) of getting trucks to the destinations are given below. Find the optimum transportation cost.

From/To	P	Q	R
A	7	3	6
B	4	6	8
C	5	8	4
D	8	4	3

6. Write short notes on the following:
- (i) Simulation,
  - (ii) Production scheduling Problem,
  - (iii) Media Allocation Problem.

Unique Paper Code : 62347502  
Name of Course : B.A. Programme CBCS (2015 Onwards)  
Name of the Paper : Programming with Python (DSE)  
Semester : V

Duration: 3 Hours

Maximum Marks: 75

**NOTE FOR TYPESETTER: Please do not change the font and spacing of text written in courier.**

### **Instructions for Candidates**

**Attempt any Four Questions. All Questions carry equal marks.**

1. Differentiate between (i) class and object (ii) constructor and destructor.

Is a data member accessible outside the class? If yes, how to access the data member? If not, why?

Define a class `Box` that has the three data members `Width`, `Height` and `Depth` and following methods:

Methods:

- Constructor to initialize the data members `Width`, `Height` and `Depth`
- `Volume` – This computes volume of the box
- `__str__` function to generate a string that may be used to display the data members of the box.

Also, write Python statements to:

- Create an object of the class `Box` with suitable values.
- Invoke the method `Volume`
- Print all the data members of the class

2. Apply the Bubble Sort scheme of sorting on the following list to sort it in ascending order. Show the content of the list after applying each iteration of Bubble sort: `=[74, 31, 82, 25, 63, 96, 49, 11]`.  
How many iterations are required to sort the list? What is the number of comparisons performed in each iteration?  
Apply Binary search to search for the item 50 in the sorted list. You should show the computation of the index at which the value is compared with 50. When will you prefer to use binary search over linear search? Justify your answer.

3.
  - The following operations are performed on a stack in the sequence given here (assume stack is initially empty): `push('Red')`, `push('Green')`, `pop()`, `push('White')`, `pop()`, `pop()`. Show the content of the stack after each operation. What will happen if one more `pop` operation is performed on the stack? Can this condition be prevented?
  - A print application processes the print jobs in the first come, first served manner. Suggest a suitable data structure for the print application. What are the permissible operations on the suggested data structure?
4.
  - Write a Python function `moveOdd(L1, L2)` that accepts two lists `L1` and `L2`. List `L1` consists of integers and list `L2` is initially empty. The function `moveOdd` removes the odd integers from the list `L1` and moves them to the list `L2`. Write python statements to apply the function `moveOdd` on the list `L1: [31, 28, 63, 86, 15, 79, 44, 52]`. What will be the content of list `L1` and `L2` after the execution of `moveOdd` function for the list `L1`?
  - Use modified list `L1` and write the python command to:
    - display last three elements,
    - middle two elements
    - delete element at index 1
    - reverse the order of the elements in the list
    - insert the list `[21, 56]` at the end of the list
5.
  - Write a Python function `smallerXY(X, Y)` that accepts two integers `X` and `Y` and returns the smaller of two. Write another function `smallerXYZ(X, Y, Z)` that uses the function `smallerXY` to find minimum of three numbers `X, Y, Z`.
  - Give the output that will be produced on execution of following code segment :
 

```

a = 12          # 12 in binary: 0000 1100
b = 7          # 7 in binary: 0000 0111
b = a & b
print(b)
a = a | b
print(a)
b = a ^ b
print(b)
a = ~b
print(a)
print(b<<3)
```

- Give the output that will be produced on execution of following code segment :

```
def add(a=3, b=5, c=7):
    return(a+b+c)

print(add())
print(add(7))
print(add(6,8))
print(add(2,4,5))
print(add(c=9))
```

- 6.
- Write a Python program that contains function `main` and function `occurs(s, ch)`. Function `occurs(s, ch)` accepts a string `s` and a character `ch` as arguments and returns the number of occurrences of character `ch` in the string `s`. The main function reads a string and a character from the keyboard, calls function `occurs` and prints the number of occurrences of the character. Do not use a built-in function to find occurrence of the character.

- Give the output that will be produced on execution of following code segment:

```
s1 = 'I am an instance of a string!!'
print(s1[-13:-21])
print(s1.title())
print(s1.find('of'))
print(s1.isalpha())
print(s1.count('a'))
```

- Consider:  
set1 = set(['P', 'Q', 'M', 'O' ])  
set2 = set(['R', 'P', 'N', 'S', 'O' ])

Give the output that will be produced on execution of the following code segment:

```
print(set2 | set1)
print(set2 - set1)
print(set2 & set1)
print('X' in set2)
```

Unique paper Code : 42347901  
Name of the Course : B.Sc. (Programme): DSE 1A  
Name of the Paper : Programming in JAVA  
Semester : V  
Year of Admission : 2015, 2016, 2017 & 2018  
Maximum Marks : 75  
Duration : Three hours

**Instructions for candidates:**

Attempt any four questions. All questions carry equal marks.



<p>Q1.</p>	<p>Is JVM a compiler or interpreter? Give justification. How does polymorphism promote extensibility? Explain with an example.</p> <p>What will be the output of the following Java program?</p> <pre> 1.  class Test { 2.  public static void main(String[] args) 3.  { 4.      int i = 0, j = 9; 5.      do { 6.          i++; 7.          if (j-- &lt; i++) { 8.              break; 9.          } 10.     } while (i &lt; 5); 11.     System.out.println(i + " " + j); 12. } 13. }</pre> <p>What are the two control structures used in Java for making decisions? Explain with suitable example.</p> <p>How many elements will be allocated in the array <code>twoD</code> after the execution of following statements?</p> <pre> int twoD[][] = new int [2][]; twoD[0] = new int [2]; twoD[1] = new int [4];</pre>
<p>Q2.</p>	<p>Write a Java program to create a user defined exception <code>MyException</code> and use this to signal an error condition if the number is negative. Write a method <code>MySqrt(int num)</code> to compute the square root of a number which raises an exception of type <code>MyException</code> if the input (i.e. <code>num</code>) is a negative number. Explain the terms <code>try</code>, <code>catch</code>, <code>throw</code> and <code>finally</code> with respect to exception handling in your program.</p> <p>Write a program in Java to replace a substring in a string by another one. Make use of <code>indexOf()</code> and <code>substring()</code> methods.</p>
<p>Q3.</p>	<p>What do you mean by applets? Explain its types. How do applets differ from application program? Write a program in Java using AWT to display a string message “Stay Safe Stay Healthy” in an applet window with pink as background colour and blue as text colour.</p> <p>Write a program in Java to read a file named <code>A.txt</code> and copy the contents in another file named <code>B.txt</code> after removing the vowels.</p> <p>Name the two types of I/O streams available in Java. What is the difference between the two types of streams?</p>

Q4.	<p>Write a program in Java to create a class <code>CountAndPrintArgs</code> to print the number of arguments passed on the command line as well as the first character of each argument passed. For example, if the command line arguments are “Mango Cucumber Apple” then the output will be:</p> <p style="text-align: center;">No. of Arguments – 3    MCA</p> <p>What are the properties of a constructor? Why are the overloaded constructors needed? Explain the use of overloaded constructors with the help of an example.</p> <p>Referring to the following Java code snippet, what data type could be returned by the method <code>check()</code> and why?</p> <pre style="text-align: center;">if (check(storeNum) != Null) {}</pre>
Q5.	<p>What is the significance of the <code>CLASSPATH</code> environment variable in creating/using a package? Write a program in Java to create an interface <code>Shape</code> that contains a method <code>Perimeter</code> to calculate the perimeter of an object. Define two classes-<code>Circle</code> and <code>Rectangle</code> with suitable fields and methods. Implement the interface <code>Shape</code> in these classes. Write the appropriate <code>main()</code> method to create object of each of the above mentioned classes and test all the methods.</p> <p>How an interface is different from a class? Show how we can create an instance of an interface. What type of variables can be declared inside an interface definition? Give examples.</p>
Q6.	<p>Write a program in Java to create a class <code>BankAccount</code> that represents a bank account including appropriate data members. Construct the methods to:</p> <ul style="list-style-type: none"> <li>Assign initial values to data members</li> <li>Deposit an amount</li> <li>Withdraw amount after checking balance</li> <li>Display the name, balance and interest earned.</li> </ul> <p>Do you need to use <code>static</code> keyword for the above bank account program? Explain.</p> <p>What is the purpose of <code>final</code> keyword in context of variable, method and class? Explain with the help of suitable examples.</p>

Unique paper Code : 42347901  
Name of the Course : B.Sc. (Programme): DSE 1A  
Name of the Paper : Programming in JAVA  
Semester : V  
Year of Admission : 2015, 2016, 2017 & 2018  
Maximum Marks : 75  
Duration : Three hours

**Instructions for candidates:**

Attempt any four questions. All questions carry equal marks.

Q1.	<p>How is encapsulation implemented in Java? What will be the output when following files are run? If there are any compilation errors, correct them and find the output, when each one of them is run?</p> <p><b>CL1.java</b></p> <pre>package P1; public class CL1 {     private int x;      CL1(int inp){ x=inp; }      public static void main(String args[]){         CL1 qq=new CL1(123);         System.out.println(" X = " +qq.x);         System.out.println("Converted X = "+qq.convert());     }      int convert(){         return (x/10) + (x%10);     } }</pre> <p><b>CL2.java</b></p> <pre>package P1; public class CL2 {     CL1 qq;      public static void main(String args[]){         qq=new CL1(12);         System.out.println(" X = " +qq.x);         System.out.println("Converted X = "+ qq.convert());     } }</pre> <p><b>CL3.java</b></p> <pre>package P2; import P1.*; public class CL3 {     public static void main(String args[]){         CL1 qq;         qq=new CL1(45);         System.out.println(" X = " +qq.x);         System.out.println("Converted X = "+qq.convert());     } }</pre>
Q2.	<p>Write a Java program that counts the words and the occurrences of each of the vowels (a, e, i, o, u) in the strings entered as command line arguments. The program will output the input strings in upper case, number of words and occurrences of each of the vowels in the input string. When are the <code>StringBuffer</code> objects preferred over <code>String</code> objects? What is meant by immutable objects?</p>

Q3.	<p>Create a class <i>Fraction</i> to represent the fraction numbers. It should have data elements for numerator and denominator of a fraction number. Include two constructors – one default and the other parameterized. Include a method that determines whether it is a proper fraction or an improper fraction. A fraction is proper if its value is strictly less than one, otherwise it is improper. For example, 4/3 is improper, whereas 2/3 is proper. Whenever an object of type Fraction is passed as parameter to <i>System.out.println()</i>, display a proper fraction as b/c and for an improper fraction number, display its mixed fraction in the form of a+b/c if b % c is not zero; otherwise, display only the integer. For example, 4/3 should printed as 1+1/3.</p> <p>Write a program that prompts the user to enter the positive integer numerator and denominator of a fraction number and determines whether it is a proper fraction and improper fraction and prints the fraction number.</p>
Q4.	<p>How do static binding and dynamic binding of methods help to achieve polymorphism? Explain with appropriate examples. Mohan has code of two abstract classes each with two abstract methods. He needs to create a new class with the properties of both these classes. Can this new class inherit from both the classes? Justify your answer. Why a class that extends an abstract class need to override all the abstract methods of the super class? Explain how we can create a class which inherits properties and methods from multiple sources?</p>
Q5.	<p>Create a class <i>PlayWithNums</i>, with a static method <i>LargerNums</i> that accepts two integer arrays and returns an array such that the <i>i</i><sup>th</sup> element of the resulting array contains the number that is greater between the elements at the same <i>i</i><sup>th</sup> index in input arrays. If the sizes of the input arrays are not same, the method should throw <i>SizeMismatchException</i>. (Assume there is a user-defined <i>SizeMismatchException</i> class available with the relevant data members and methods in it). Show the use of <i>LargerNums</i> method in <i>main()</i> method of <i>PlayWithNums</i> class. For example, <i>LargerNums</i> ([2, 7, 3, 12], [3, 1, 2, 16]) will result in [3, 7, 3, 16].</p> <p>What happens to your program if you do not declare <i>LargerNums</i> as static? What is the significance of declaring a static data member in a class?</p>
Q6.	<p>You are provided with a package <i>pkgInt</i> having a class <i>clsInt</i>. It has a method <i>Average()</i> that takes variable number of integers as parameters and returns the average of these integers.</p> <pre>package pkgInt; public class clsInt{     float Average(int ... Ints)     { //Returns the average of the input integers     } }</pre> <p>Write the code of the method <i>Average</i> (int ... Ints) . Use this function to report average of integers read from a file.</p> <p>Write a program in Java, to create an applet that prints the unique paper code and the subject of this examination in the centre.</p>

Unique Paper Code : 62413326\_OC  
Name of the Paper : Computer Applications in Business  
Name of the Course : B.A.Prog.  
Semester : III  
Duration : 3 hours  
Maximum Marks : 75 Marks

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**Instructions for candidates**

Attempt **any four** questions. All questions carry equal marks.

1. Rajni is a student. Due to lockdown she has to make arrangement for attending her online classes and solve the practice questions at home. When she made online search she came to know about micro-computers, mainframes and supercomputers. You are required to compare these type of computers based on their features and utility and finally suggest Rajni which type of computer she should buy.
2. What do you understand by the computer software? Differentiate between system software and application software and also give two examples of each types of the software.
3. What do you mean by a computer network? How does wired networking differ from wireless networking? What are the challenges associated with wireless networking?
4. In what ways word processing is helpful to university students? Describe different features of word processing you would like to apply while preparing your project report?
5. What is an electronic spreadsheet? What are the important features of spreadsheet software? Explain any two types of charts that you use for data representation.
6. Do you agree that database management system is better than traditional file system as data management model? Give at least six points of differences between both the data management models.

Unique Paper Code : **62347501**  
Name of the Course : **B.A. Programme (Computer Applications)**  
Name of the Paper : **Visual Programming**  
Semester : **V**  
Duration : **3 Hours**  
Maximum Marks : **75**  
Year of Admission : **2015 - 2018**

### **Instructions for Candidates**

All questions carry equal marks. Attempt any **FOUR** questions.

Q. 1) For each of the control names given below, identify the type of controls and specify one property: *lblAddress*, *cmdExit*, *txtName* and *optTextBlue*. Write VB statement to change a Label *lbl* Caption to italic at run time. For Image Control *img1* in VB, write steps to make a graphic appear in it. Write VB statements to hide the image and to ensure that it fills the Image Control completely. Find the value of the variable *sum* in the following VB code:

```
sum = 0  
count = 1  
For count = 1 to 10  
    sum = sum + count  
    If sum >= 10 Then  
        Exit For  
    EndIf  
Next
```

Q. 2) Write VB code to search an element in a Two-Dimensional array. The VB code should display the index if the element is found, otherwise it should display -1. Explain with the help of an example how to convert a For/Next structure to Do/Loop structure. Write VB code to change the text color of the form depending on the selection from the three colors given in the form.

Q. 3) Write a VB code to calculate and display the area and circumference of a circle using the relation  $\text{Area} = \pi r^2$  and  $\text{Circumference} = 2\pi r$  where  $\pi = 3.14$  and  $r$  is user input. What will be the value of  $K$  on execution of the following VB statements:  $K = y \wedge (x * z) + 2$  and  $K = y \wedge (x * z + 2) / y$  (Assume that  $x = 3$ ,  $y = 2$  and  $z = 2$ ). What will be the output of the following VB code, assuming that  $a = 10$ ,  $b = 20$  and  $c = 30$ ?

```
If a >= 10 And b > 20 Then
    Print "Hello"
ElseIf a >= 10 And c > 30 Then
    Print "Hi"
Else
    Print "Bye"
End If
```

Rewrite the If statement using Select Case statement. Write steps to create a breakpoint at Else. How does it affect the execution of the VB program?

Q. 4) Write steps to design a VB form that takes inputs: principal amount ( $P$ ), rate of interest ( $R$ ) and number of years ( $N$ ). The form contains the Command Button *cmd1* that calculates and displays compound interest as per the given formula

$$I = P * (1 + R/100)^N$$

The form also contains Command Button *cmd2* that clears the input fields. Write VB code to implement Command Button *cmd1* and *cmd2*. Write VB statement to: Append "OBE" to the content of a Text Box *txt1*; Centrally align the content of a Label *lbl*.



Q. 5) Write the output of the following VB statements:

FormatDateTime("1/1/2001", vbGeneralDate)

FormatNumber(2356.789, 2)

FormatPercent(.123, 2)

Printer.Print 45, 71, 34, 12, 58, 4

Printer.Print 45; 71; 34; 12; 58; 4

Write VB procedure to print a table showing the temperature in centigrade from 0° to 100° and the corresponding values in Fahrenheit using the relation

$$C / 5 = F - 32 / 9$$

Write steps required to convert a project *prj1* into an .exe file.

Q. 6) Write VB code to calculate and display the *Gross Salary* and *Net Salary* of an employee based on the given criteria:

$$\text{Gross Salary} = \text{Basic Salary} + \text{Allowances}$$

$$\text{Net Salary} = \text{Gross Salary} - \text{Deductions}$$

Draw the user interface (form) for the above scenario and label the controls.

Declare an array of size 30 for a user defined datatype *Bank* in VB for the following customer data: *Cust\_ID*, *ACC\_Number*, *Cust\_Name*, *Age*, *Amount*, *Address* and *Phone\_No*. Write VB code to display the list of customers having age greater than 60.