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हार्दिक आभार सहित

KEC

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Data Structure and Algorithms

Course code: CACS201 **Year / Semester:** II/III
Course Title: Data Structure and Algorithms **Class load:** 6 hrs. /Weak
(**Theory:** 3 Hrs. **Practical:** 3 Hrs.)

Unit 1: Introduction to Data structure **2 Hrs**
Definition, Abstract data types, Importance of data structure.

Unit 2: The Stack **3 Hrs**
Introduction, Stack as an ADT, POP and PUSH operation, Stack applications: evaluation of infix, postfix and prefix Expressions, conversion of expression.

Unit 3: Queue **3 Hrs**
Introduction, Queue as an ADT, Primitive operations in Queue, Linear and circular queue and their applications, Enqueue and Dequeue, Priority queue

Unit 4: List **2 Hrs**
Introduction, Static and Dynamic List structure, Array implementation of list, Queues as a list

Unit 5: Linked lists **5 Hrs**
Introduction, Linked List as an ADT, Dynamic implementation, insertion and deletion of note to and from a list, insertion and deletion after and before nodes, linked stacks and queues, doubly linked list and its advantages.

Unit 6: Recursion **4 Hrs.**
Introduction, Principle of recursion, recursion vs. iteration, recursion example: TIH and Fibonacci series, Applications of Recursion, search tree

Unit 7: Trees **5 Hrs.**
Introduction, Basic operation in Binary tree, tree search and insertion/Deletion, Binary tree traversals (Pre-order, post-order and in-order), Tree Height, level, and Depth, Balanced trees: AVL Balanced trees, Balancing algorithm, the Huffman algorithm, Game tree, B-tree.

Unit 8: Sorting **5 Hrs.**
Introduction, internal and external Sort, insertion and selection sort, exchange sort, Bubble and Quick sort, Merge and Radix sort, Shell Sort, Binary sort, Heap sort as priority queue, efficiency of sorting, Big O notation.

Unit 9: Searching **5 Hrs.**
Introduction to search technique: essential of search, sequential search, binary search, tree search, general search tree, Hashing: Hash function and hash tables, collision resolution techniques, efficiency comparison of different search technique

Unit 10: Graphs **5 Hrs**
Introduction, Graph as an ADT, transitive closure, Warshall's Algorithm, Types of graph, graph traversal and spanning forests, Kruskal's and Round robin algorithms, Shortest path algorithm, Greedy algorithm, Dijkstra's Algorithm

Unit 11: Algorithms **5 Hrs.**
Deterministic and Non-deterministic algorithm, divide and conquer algorithm, series and parallel algorithm, heuristic and approximate algorithms.

Laboratory Works

There shall be ten lab exercises based on C or JAVA

1. Implementations of different operations related to stack
2. Implementations of different operations related to linear and circular queues
3. Solutions of TOH and Fibonacci Series using recursion
4. Implementations of different operations related to linked list: singly and doubly linked
5. Implementations of trees: AVL trees, Balancing of AVL
6. Implementations of merge sort
7. Implementations of different searching technique: sequential, tree and binary
8. Implementations of Graphs: Graph traversals
9. Implementations of Hashing
10. Implementations of Heap

TRIBHUVAN UNIVERSITY

Faculty of Humanities & Social Sciences

OFFICE OF THE DEAN

TU QUESTIONS-ANSWERS 2019

Bachelor in Computer Applications — Full Marks: 60
Course Title: Data Structure & Algorithms — Pass Marks: 24
Course Code: CACS 201 — Time: 3 hr.
Semester: III

Candidates are required to answer the questions in their own words as far as possible.

Section A

Attempt all the questions **(10 × 1 = 10)**

1. Circle (O) the correct answer.

i) What is the measurement for time complexity of an algorithm?
a) Counting microseconds b) Counting kilobytes of algorithms
c) Counting number of key operations d) Counting number of statements

ii) Which of the following is the result of evaluation of 5 7 4 - * 8 4 / +?
a) 5 b) 8
c) 10 d) 17

iii) What is the recursive formula for post order traversal of binary tree?
a) Left-Root-Right b) Root-Left-Right
c) Left-Right-Root d) Right-Left-Root

iv) What is the number of disk movement in TOH with 4 disks?
a) 9 b) 14
c) 17 d) 15

v) What is the Big-Oh of best case complexity of insertion sort?
a) O (n) b) O (n logn)
c) O (1) d) O (n^2)

vi) How does the rear index incremented in circular queue?
a) front=(rear+1)%SIZE b) rear=(rear+1)%SIZE
c) rear=rear+1 d) rear=(rear-1)%SIZE

vii) A variation of linked list in which none of the node contains NULL pointer is
a) Singly b) Multiple
c) Circular d) Doubly

viii) Which of the following data structure is used in depth first search of graph?
a) Stack b) Queue
c) Linked List d) None of the above

ix) Which of the following is true for B-Tree of order M?
a) Leaf nodes should be at different level
b) All the key values within a node must be in descending order
c) Every node has at least M children
d) All non-leaf nodes with M-1 keys must have M number of children

x) Which of the following is not a hash function?
a) Division remainder b) Folding
c) Chaining d) Mid square

Answer-Key

i. (d)	ii. (d)	iii. (c)	iv. (d)	v. (a)	vi. (b)	vii. (c)	viii. (a)	ix. (d)	x. (c)

Group B

Attempt any SIX questions. [6x5 = 30]

2. What is Data Structure? Show the status of stack converting following infix expression to prost fix P + Q – (R*S/T+U)-V*W [1+4]

Ans: The data structure is basically a technique of organizing and storing of different types of data items in computer memory. It is considered as not only the storing of data elements but also the maintaining of the logical relationship existing between individual data elements. It can also be defined as a mathematical or logical model, which relates to a particular organization of different data elements. Thus, a data structure is the portion of memory allotted for a model, in which the required data can be arranged in a proper fashion. Data structure mainly specifies the following four things:

- Organization of data.
- Accessing methods
- Degree of associativity
- Processing alternatives for information

To develop a program of an algorithm, we should select an appropriate data structure for that algorithm. Therefore, algorithm and its associated data structures form a program.

Algorithm + Data structure = Program

Trace of Conversion of infix to postfix Algorithm

The following tracing of the algorithm illustrates convert infix to postfix the algorithm. Consider an infix expression P + Q – (R*S/T+U)-V*W

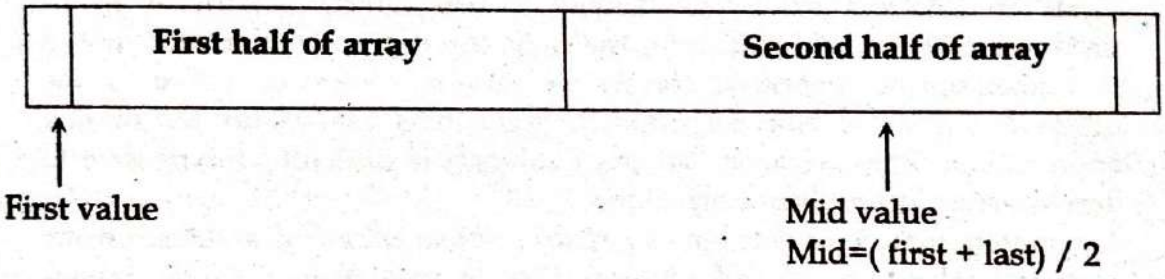
Scan character	Poststack	Opstack
P	P	.....
+	P	+
Q	PQ	+
-	PQ +	-
(	PQ +	-(
R	PQ + R	-(
*	PQ + R	-(*
S	PQ + RS	-(*
/	PQ + RS *	-(/
T	PQ + RS * T	-(/
+	PQ + RS * T /	-(+
U	PQ + RS * T /U	-(+
)	PQ + RS * T /U +	-
-	PQ + RS * T /U + -	-
V	PQ + RS * T /U + -V	-
*	PQ + RS * T /U + -V	- *
W	PQ + RS * T /U + -V W	- *
.....	PQ + RS * T /U + -V W * -	.....

3. Write binary search. Consider a hash table of size 10; insert the keys 62, 37, 36, 44, 67, 91 and 107 using linear probing. [2+3]

Ans: The binary search algorithm can be used with only sorted list of element. That means, binary search can be used only with list of element which are already arranged in an order. The binary search cannot be used for list of

element which is in random order. This search process starts comparing of the search element with the middle element in the list. If both are matched, then the result is "element found". Otherwise, we check whether the search element is smaller or larger than the middle element in the list. If the search element is smaller, then we repeat the same process for left sub list of the middle element. If the search element is larger, then we repeat the same process for right sub list of the middle element. We repeat this process until we find the search element in the list or until we left with a sub list of only one element. And if that element also doesn't match with the search element, then the result is "Element not found in the list". The logic behind this technique is given below:

1. First find the middle element of the array
2. Compare the middle element with an item.
3. There are three cases:
   a. If it is a desired element then search is successful
   b. If it is less than desired item then search only the first half of the array.
   c. If it is greater than the desired element, search in the second half of the array.
4. Repeat the same process until element is found or exhausts in the search area.



Hash table of size 10; insert the keys 62, 37, 36, 44, 67, 91 and 107 using linear probing

Soln: When x=62

h(62)=62%10=2

Insert key 62 in hash-table in location 2

When x=37

h(37)=37%10=7

Insert key 37 in hash-table in location 7

When x=36

h(36)=36%10=6

So insert key 37 in hash-table location 6

When x=44

h(44)=44%10=4

Insert key 44 in hash-table location 4

When x=67

h(67)=67%10=7 (Collision occur)

Insert key 67 in hash-table in next possible vacant location of 7 is 8

When x=91

h(91)=91%10=1

So insert key 91 in hash-table location 1

When x=107

h(107)=107%10=7 (Collision occur)

Insert key 107 in hash-table in next possible vacant location of 7 is 9

0	1	2	3	4	5	6	7	8	9
None	91	62	None	44	None	36	37	67	107

4. What are deterministic and non-deterministic algorithms? Explain greedy algorithm.

Ans: Deterministic and Non-deterministic algorithm

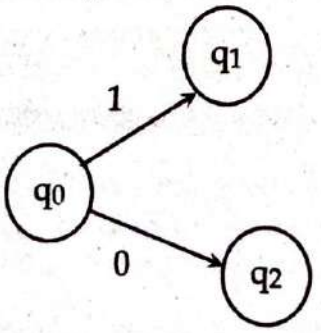
In computer science, a deterministic algorithm is an algorithm which, given a particular input, will always produce the same output, with the underlying machine always passing through the same sequence of states. A deterministic algorithm is an algorithm that is purely determined by its inputs, where no randomness is involved in the model. Deterministic algorithms will always come up with the same result given the same inputs.

A non-deterministic algorithm can provide different outputs for the same input on different executions. Unlike a deterministic algorithm which produces only a single output for the same input even on different runs, a non-deterministic algorithm travels in various routes to arrive at the different outcomes. Non-deterministic algorithms are useful for finding approximate solutions, when an exact solution is difficult or expensive to derive using a deterministic algorithm.

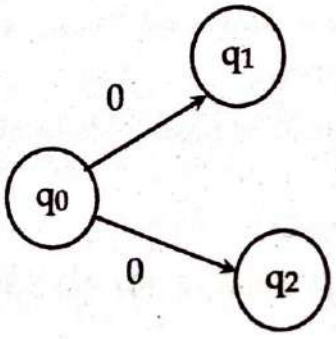
A non-deterministic algorithm is capable of execution on a deterministic computer which has an unlimited number of parallel processors. A non-deterministic algorithm usually has two phases and output steps. The first phase is the guessing phase, which makes use of arbitrary characters to run the problem.

The second phase is the verifying phase, which returns true or false for the chosen string. There are many problems which can be conceptualized with help of non-deterministic algorithms including the unresolved problem of P vs. NP in computing theory. Non-deterministic algorithms are used in solving problems which allow multiple outcomes. Every outcome the non-deterministic algorithm produces is valid, regardless of the choices made by the algorithm during execution.

Example:



Deterministic Algorithm



Non-deterministic Algorithm

Difference between Deterministic and Non-deterministic Algorithms

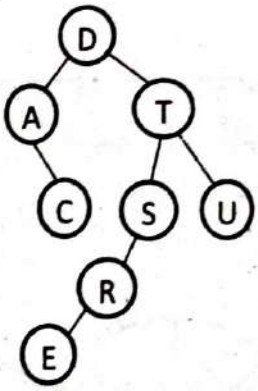
Deterministic algorithm	Non-deterministic algorithm
For a particular input the computer will give always same output.	For a particular input the computer will give different output on different execution.
Can solve the problem in polynomial time.	Can't solve the problem in polynomial time.
Can determine the next step of execution.	Cannot determine the next step of execution due to more than one path the algorithm can take.
Backtracking is allow	Backtracking is not always allow

What is a 'Greedy algorithm'?

A greedy algorithm, as the name suggests, always makes the choice that seems to be the best at that moment. This means that it makes a locally-optimal choice in the hope that this choice will lead to a globally-optimal solution. Assume that you have an objective function that needs to be optimized (either maximized or minimized) at a given point. A Greedy algorithm makes greedy choices at each step to ensure that the objective function is optimized. The Greedy algorithm has only one shot to compute the optimal solution so that it never goes back and reverses the decision.

5. Draw a BST from the string DATASTRUCTURE and traverse the tree in post order and preorder. [3+2]

Ans: The BST of given string is:



Post-order traversal: C, A, E, R, S, U, T, D

Pre-order traversal: D, A, C, T, S, R, E, U

6. Define circular queue? How does circular queue overcome the limitation of linear queue? Explain. [2+3]

Ans: A circular queue is one in which the insertion of a new element is done at very first location of the queue if the last location of the queue is full. When the rear part reaches at the last index of linear queue but front part is not at first index of the queue then in this case if we try to insert some elements, then according to the logic when **rear** is N-1 then it encounters an overflow situation. But there are some elements are left blank at the beginning part of the array. To utilize those left over spaces more efficiently, a circular fashion is implemented in queue representation. The circular fashion of queue reassigns the rear pointer with 0 if it reaches N-1 and beginning elements are free and the process is continued for deletion also. Such queues are called Circular Queue.

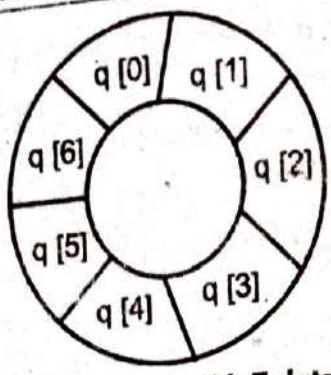
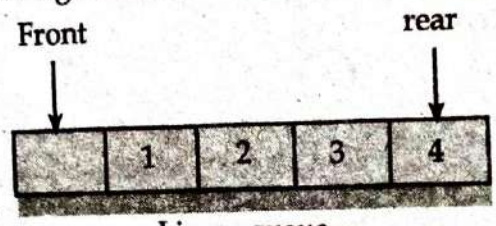


Fig: Circular queue with 7 data items

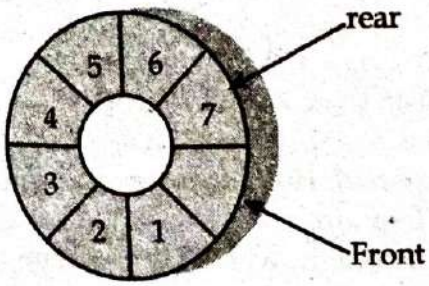
A circular queue overcomes the problem of unutilized space in linear queue implementation as array. In circular queue we sacrifice one element of the array thus to insert n elements in a circular queue we need an array of size n+1(or we can insert one less than the size of the array in circular queue).

How does circular queue overcome the limitation of linear queue?

To understand why circular queue is better in terms of space usage, consider a situation. We are maintaining a circular queue and a linear queue for storing some items. Now when we remove these items from the front of the queue, the space in the front of the linear queue can't be used anymore, whereas in the circular queue the space still remains available for adding any further items. The figure below should clarify things.



Linear queue



Circular queue

Thus by using circular queue we can reuse the previous deleted items memory location.

7. **What is singly linked list? Write an algorithm to add a node at the beginning and end of singly linked list.** [1+4]

Ans: To overcome the disadvantage of fixed size arrays linked list were introduced. A linked list consists of nodes of data which are connected with each other. Every node consists of two fields' data (info) and the link (next). The nodes are created dynamically.

- **Info:** the actual element to be stored in the list. It is also called data field.

- **Link:** one or two links that point to next and previous node in the list. It is also called next or pointer field.

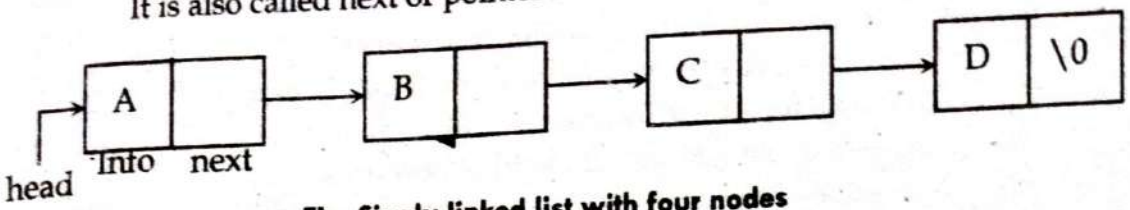


Fig: Singly linked list with four nodes

Structure of a node of singly linked list

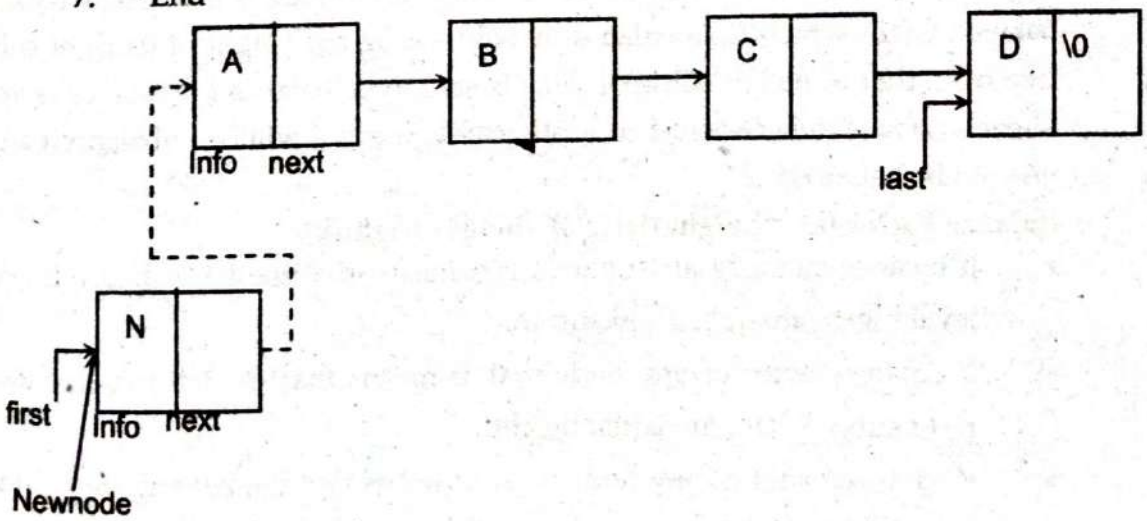
We can define a node as follows:

```
struct Node
{
int info;
struct Node *next;
};
typedef struct Node NodeType;
NodeType  *first;  //first is a pointer type structure variable that points to first node
NodeType  *last;  //last is a pointer type structure variable that points to last node
```

An algorithm to insert a node at the beginning of the singly linked list

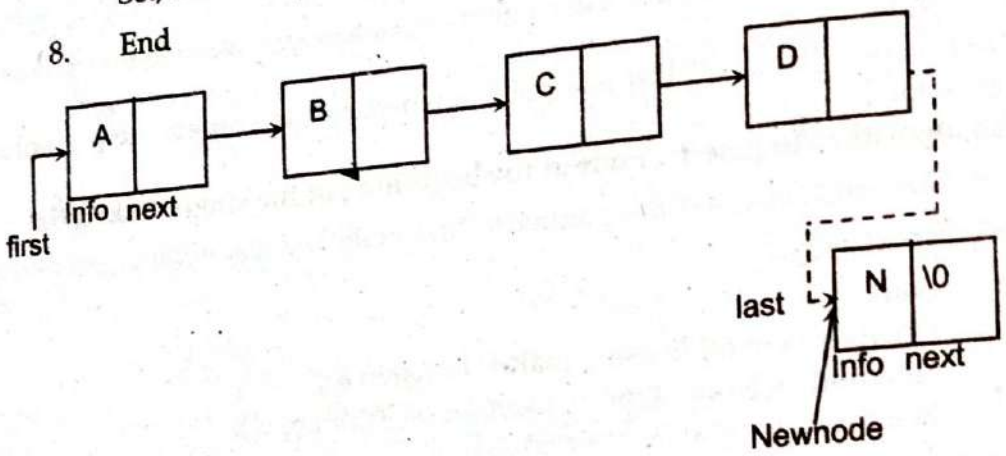
Let 'first' and 'last' are the pointer to first node and last node in the current list respectively.

1. Start
2. Create a new node using **malloc** function as,
   Newnode=(NodeType*)malloc(sizeof(NodeType));
3. Read data item to be inserted say 'el'
4. Assign data to the info field of new node
   Newnode.info=el;
5. Set next of new node to first
   Newnode.next=first;
6. Set the first pointer to the new node
   first = Newnode;
7. End



An algorithm to insert a node at the end of the linked list:

1. Start
2. Create a new node using **malloc** function as,
   Newnode=(NodeType*)malloc(sizeof(NodeType));
3. Read data item to be inserted say 'el'
4. Assign data item to the info field of new node
   Newnode→info=el;
5. Set next of new node to null
   Newnode→next=null;
6. If (first ==null) then
   Set, first =last=Newnode and exit.
7. else
   Set, last→next=newnode;
   Set, last=newnode;
8. End



8. Define AVL tree. Construct AVL tree from given data set: 4, 6, 12, 9, 5, 2, 13, 8, 3, 7, 11. **[2+3]**

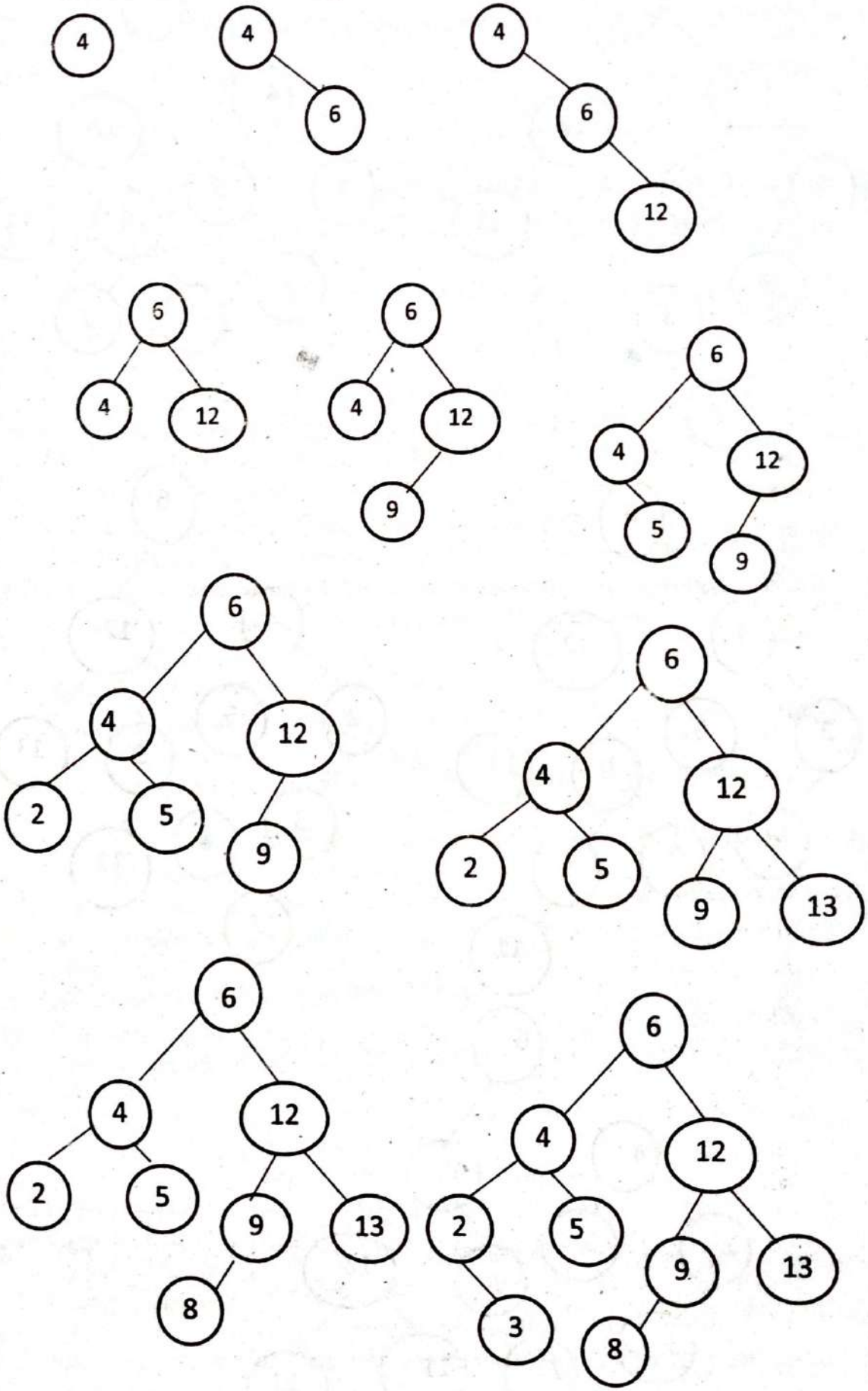
Ans: AVL tree

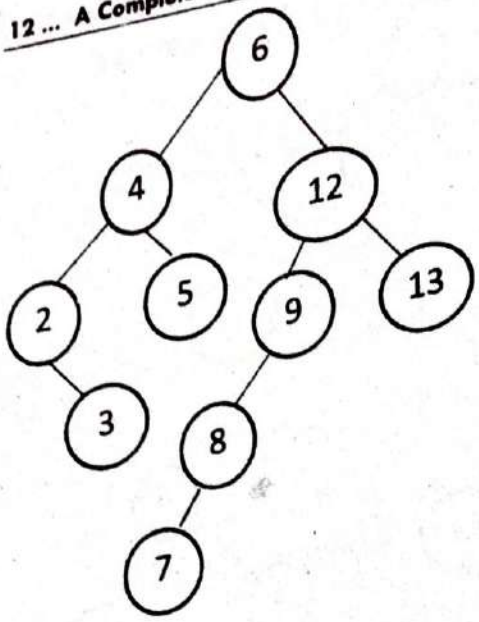
AVL Tree is invented by GM Adelson - Velsky and EM Landis in 1962. The tree is named AVL in honour of its inventors. AVL Tree can be defined as height balanced binary search tree in which each node is associated with a balance factor which is calculated by subtracting the height of its right sub-tree from that of its left sub-tree. Tree is said to be balanced if balance factor of each node is in between -1 to 1, otherwise, the tree will be unbalanced and need to be balanced.

Balance Factor (k) = height (left(k)) - height (right(k))

- If balance factor of any node is 1, it means that the left sub-tree is one level higher than the right sub-tree.
- If balance factor of any node is 0, it means that the left sub-tree and right sub-tree contain equal height.
- If balance factor of any node is -1, it means that the left sub-tree is one level lower than the right sub-tree.

Construct AVL tree from given data set: 4, 6, 12, 9, 5, 2, 13, 8, 3, 7, 11

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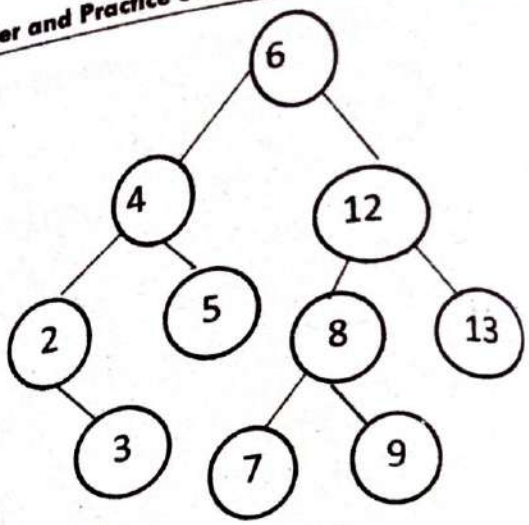
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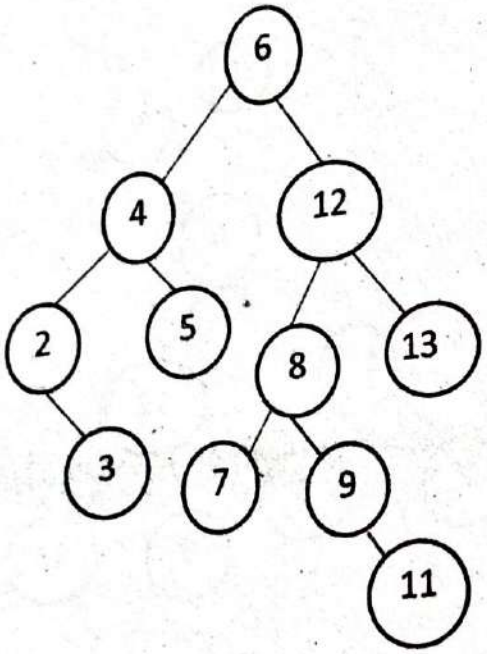
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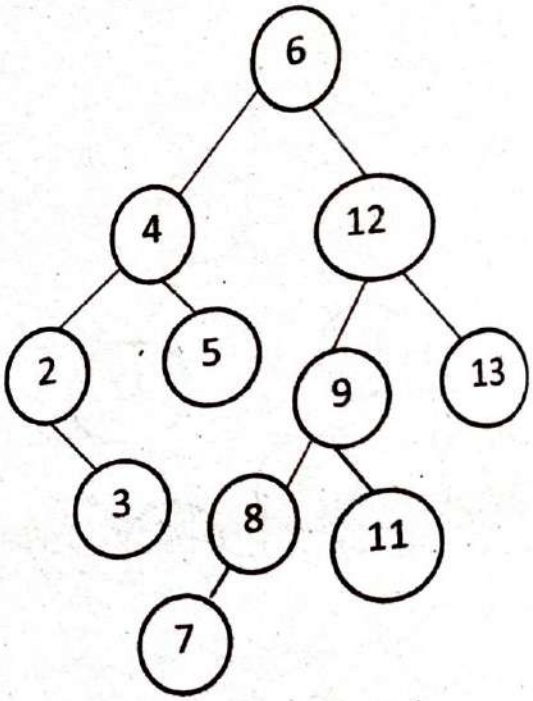
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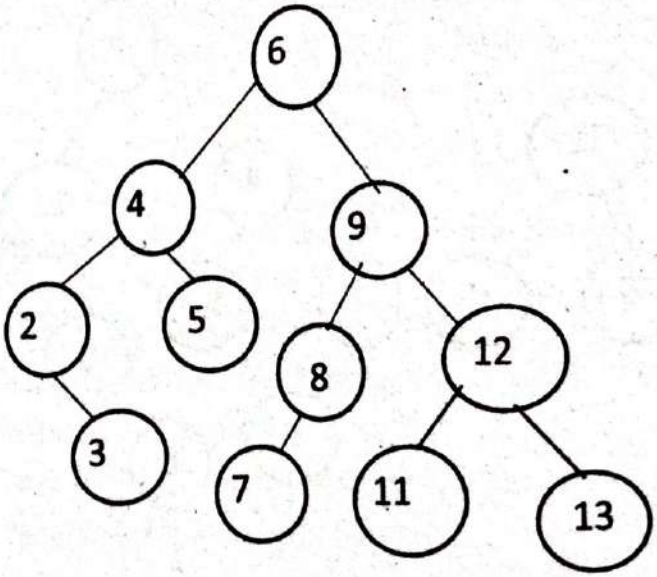
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Group C

Attempt any TWO questions. **[2x10 = 20]**

9. **What is stack? List the applications of stack. Write an algorithm or procedure to perform PUSH and POP operation in stack.** **[1+2+7]**

Ans: A stack is a linear data structure in which an element may be inserted or deleted only at one end called the top end of the stack i.e. the elements are removed from a stack in the reverse order of that in which they were inserted into the stack. Stack uses a variable called top which points topmost element in the stack. top is incremented while **pushing** (inserting) an element in to the stack and decremented while **popping** (deleting) an element from the stack. It is named stack as it behaves like a real-world stack, for example – a deck of cards or a pile of plates, etc.

Applications of Stack

Stack is used directly and indirectly in the following fields:

- To evaluate the expressions (postfix, prefix)
- To keep the page-visited history in a Web browser
- To perform the undo sequence in a text editor
- Used in recursion
- To check the correctness of parentheses sequence
- To pass the parameters between the functions in a C program
- Can be used as an auxiliary data structure for implementing algorithms
- Can be used as a component of other data structures
- Tree Traversals

Adding an element onto the stack (push operation)

Adding an element into the top of the stack is referred to as push operation. Push operation involves following two steps.

- Increment the variable Top so that it can now refer to the next memory location.
- Add element at the position of incremented top. This is referred to as adding new element at the top of the stack.

Stack is over flown when we try to insert an element into a completely filled stack therefore, our main function must always avoid stack overflow condition.

Algorithm for PUSH operation of Stack

Let Stack [MAXSIZE] is an array to implement the stack. The variable top denotes the top of the stack. This algorithm adds or inserts an item at the top of the stack

1. Start
2. Check for stack overflow as

if top==MAXSIZE-1 then
print "Stack Overflow" and Exit the program
else
Increase top by 1 as
Set, top=top+1

3. Read elements to be inserted say element
4. Set, Stack[top]= element //Inserts item in new top position
5. Stop

Implementation of push algorithm in C language

```
void push (int val) //n is size of the stack
{
if (top == MAXSIZE )
printf("\n Stack Overflow");
else
{
        top = top +1;
        stack[top] = val;
}
}
```

Deletion of an element from a stack (Pop operation)

Deletion of an element from the top of the stack is called pop operation. The value of the variable top will be decremented by 1 whenever an item is deleted from the stack. The top most element of the stack is stored in another variable and then the top is decremented by 1. The operation returns the deleted value that was stored in another variable as the result. The underflow condition occurs when we try to delete an element from an already empty stack.

Algorithm for POP operation

This algorithm deletes the top element of the stack and assigns it to a variable element

1. Start
2. Check for the stack Underflow as

If top<0 then
Print "Stack Underflow" and Exit the program
else
Remove the top element and set this element to the variable as
Set, element=Stack [top]
Decrement top by 1 as
Set, top=top-1

3. Print 'element' as a deleted item from the stack
4. Stop

The C function for POP operation

Alternatively, we can define the POP function as give below:

```
void pop( )
{
int item;
if(top < 0)  //Checking Stack Underflow
printf("The stack is Empty");
else
{
item = stack[top]; //Storing top element to item variable
top = top-1; //Decrease top by 1
printf("The popped item is=%d", item); //Displaying the deleted items
}
}
```

10. What is heap? Explain quick sort algorithm with Big-oh notation in best case, average case and worst case and trace it to sort the data: 8, 10, 5, 12, 14, 5, 7, 13. **[2+2+6]**

Ans: A heap is an almost complete binary tree whose elements have keys that satisfy the following heap property: the keys along any path from root to leaf are descending (i.e. non-increasing). Heaps could represent family descendant trees because the heap property means that every parent is older than its children. In brief, a heap is an almost complete binary tree of n nodes such that the value of each node is less than or equal to the value in parent node. This type of heap is called max heap. By default, the heap is max heap. There are two types of heap:

1. Max heap and
2. Min heap

Heaps are used to implement priority queues and to the heap sort algorithm.

Example: Construct a heap from a set of 6 elements {15, 19, 10, 7, 17, 16}

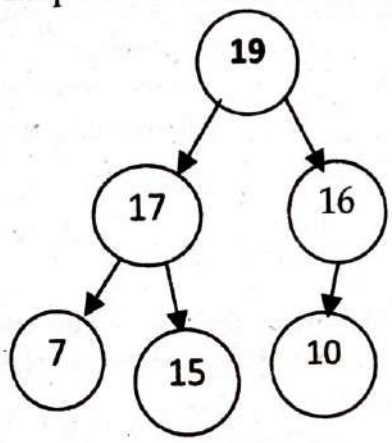


Fig: Heap of given set of elements

Quick Sort

As its name implies, **quick sort** is a fast divide-and-conquer algorithm. Its average running time is O(n logn) . Its speed is mainly due to a very tight and highly optimized inner loop. It has quadratic worst-case performance, which can be made statistically unlikely to occur with a little effort. On the one hand, the quick sort algorithm is relatively simple to understand and prove correct because it relies on recursion. On the other hand, it is a tricky algorithm to implement because minute changes in the code can make significant differences in running time. It has two phases:

- The partition phase and
- The sort phase

As we will see, most of the work is done in the partition phase - it works out where to divide the work. The sort phase simply sorts the two smaller problems that are generated in the partition phase. This makes Quick sort a good example of the **divide and conquers** strategy for solving problems.

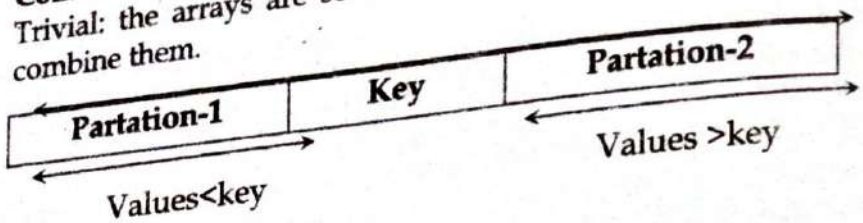
- **Divide**

  Partition the array A[l…r] into two sub-arrays A[l…pivot] and A[pivot+1...r], such that each element of A[l...pivot] is smaller than or equal to each element in A[pivot+1...r].

- **Conquer**

  Recursively sort A[l…pivot] and A[pivot+1…r] using Quick sort

- **Combine**
  Trivial: the arrays are sorted in place. No additional work is required to combine them.



Algorithm

1. Start
2. Choose a pivot
3. Set a left pointer and right pointer
4. Compare the left pointer element (lelement) with the pivot and the right pointer element (relement) with the pivot.
5. Check if lelement<pivot and relement>pivot:
1. If yes, increment the left pointer and decrement the right pointer
2. If not, swap the lelement and relement
6. When left >= right, swap the pivot with either left or right pointer.
7. Repeat steps 1 - 5 on the left half and the right half of the list till the entire list is sorted.
8. Stop

Time Complexity

Best Case

Quick sort gives best time complexity when elements are divided into two partitions of equal size; therefore recurrence relation for this case is;

$T(n) = 2T(n/2) + O(n)$

By solving this recurrence, we get,

$T(n)=O(n \log n)$

Worst case

Quick sort gives worst case when elements are already sorted. In this case one partition contains the n-1 elements and another partition contains no element. Therefore, its recurrence relation is;

$T(n) = T(n-1) + O(n)$

By solving this recurrence relation, we get

$T(n)=O(n^2)$

Average case

It is the case between best case and worst case. All permutations of the input numbers are equally likely. On a random input array, we will have a mix of well balanced and unbalanced splits. Good and bad splits are randomly distributed across throughout the tree. Suppose we are alternate: Balanced, Unbalanced, Balanced.

$B(n)= 2UB(n/2) + \Theta(n)$ Balanced

$UB(n)= B(n-1) + \Theta(n)$ Unbalanced

Solving: $B(n)= 2(B(n/2-1) + \Theta(n/2)) + \Theta(n)$

$= 2B(n/2-1) + \Theta(n)$

$= \Theta(n \log n)$

Sort the data: 8, 10, 5, 12, 14, 5, 7, 13 by using Quick sort

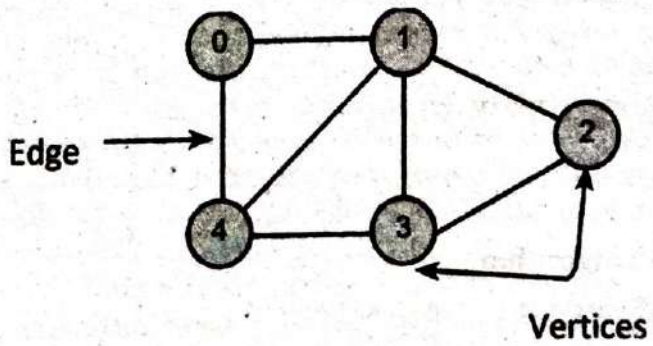
8	10	5	12	14	5	7	13
L, P							
8	10	5	12	14	5	7	13
P	L				R		
8	7	5	12	14	5	10	13
P	L						R
8	7	5	12	14	5	10	13
P	L			R			
8	7	5	5	14	12	10	13
P	L			R			
8	7	5	5	14	12	10	13
P	R			L			
5	7	5	8	14	12	10	13
P, L	R		P, L		R		
5	7	5	8	14	12	10	13
P, R	L	P			L, R		
5	7	5	8	13	12	10	14
	P, L	R	P, L		R		
5	7	5	8	13	12	10	14
	P	R, L	P		L, R		
5	5	7	8	10	12	13	14
5	5	7	8	10	12	13	14
	P, L				R		
5	5	7	8	10	12	13	14
	P, R				L		
5	5	7	8	10	12	13	14
5	5	7	8	10	12	13	14

11. Define graph and tree data structure. Explain breadth first traversal and depth first traversal with example.

Ans: **Graph:** A graph is collection of two sets V and E where V is a finite non-empty set of vertices and E is a finite non-empty set of edges.

- Vertices are nothing but the nodes in the graph.
- Two adjacent vertices are joined by edges.
- Any graph is denoted as G = {V, E}.

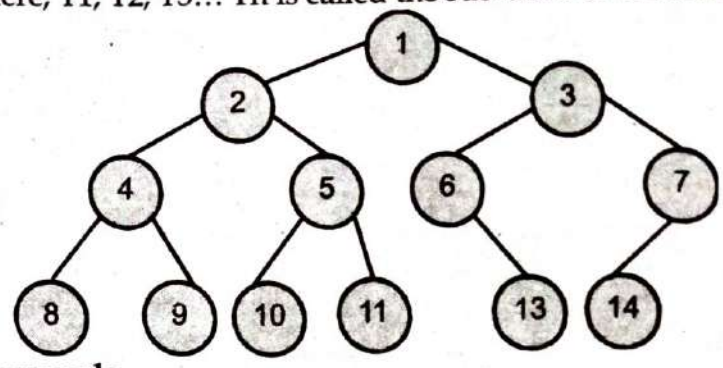
Example:



Tree

A tree is a finite set of one or more nodes such that:

- There is a specially designated node called root.
- The remaining nodes are partitioned into n>=0 disjoint sets T1, T2, T3, ..., Tn
- Where, T1, T2, T3... Tn is called the sub-trees of the root.



Graph Traversals

Traversing a graph means visiting all the vertices in a graph exactly one. In tree traversal, there is a special node root, from which the traversal starts. But in graph all nodes are treated equally. So the starting node in graph can be chosen arbitrarily. In general, for diagrammatic illustration, the left-up node is taken as starting vertex for traversal. Two common approaches for traversal are:

- Breadth First Search Traversal (BFS)
- Depth First Search Traversal (DFS)

Breadth First Search Traversal (BFS)

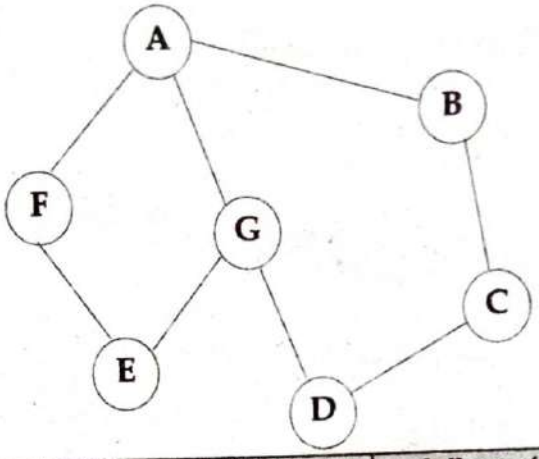
The traversal starts at a node v, after marking the node the traversal visits all incident edges to node v after marking the nodes and then moving to an adjacent node and repeating the process. The traversal continues until all unmarked nodes in the graph have been visited. A queue is maintained in the technique to maintain the list of incident edges and marked nodes.

Algorithm

```
BFS (G, s) //s is start vertex
{
T = {s};
L = Φ;  //an empty queue
Enqueue (L, s);
while (L != Φ )
{
v = Dequeue (L);
For each neighbor w to v
if ( w∉ L && w∉ T )
{
Enqueue (L, w);
T = T U {w}; //put edge {v, w} also
}
}
}
```

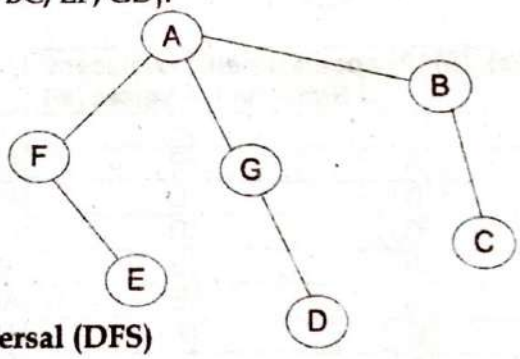
Tracing of BFS algorithm

Let's take start vertex is v_0 = A



Queue (Q)	Dequeue item (v)	Set of vertices (L)	Adjacent vertex(w)	Edge list (T)
A	.....	.....	.....	.....
.....	A	A	B	AB
B	.....	A	F	AB, AF
B F	.....	A	G	AB,AF,AG
BFG	B	A, B	C	AB,AF,AG,BC
FGC	F	A,B,F	E	AB,AF,AG,BC,EF
GCE	G	A,B,F,G	D	AB,AF,AG,BC,EF,GD
CED	C	A,B,F,G,C	.....	AB,AF,AG,BC,EF,GD
ED	E	A,B,F,G,C,E	.....	AB,AF,AG,BC,EF,GD
D	D	A,B,F,G,C,E,D	.....	AB,AF,AG,BC,EF,GD
.....	.....	A,B,F,G,C,E,D	.....	AB,AF,AG,BC,EF,GD

The resulting BFS order of visitation is returned in the list L = (A, B, F, G, C, E, D), and the resulting BFS spanning tree is returned in the set T = {AB, AF, AG, BC, EF, GD}.



Depth First Traversal (DFS)

DFS traversal of a graph produces a **spanning tree** as final result. **Spanning Tree** is a graph without any loops. We use **Stack data structure** with maximum size of total number of vertices in the graph to implement DFS traversal of a graph.

A depth first search of an arbitrary graph can be used to perform a traversal of a general graph. The technique picks up a node and marks it. An unmarked adjacent node to previous node is then selected and marked, becomes the new start node, possibly leaving the previous node with unexplored edges for the present. The traversal continued recursively, until all unmarked nodes of the current path are visited. The process is continued for all the paths of the graph. If this cannot be done, move back to another vertex and repeat the process. The whole process is continued until all the vertices are met. This method of search is also called backtracking. A Stack data structure is maintained in the technique to maintain the list of incident edges and marked nodes.

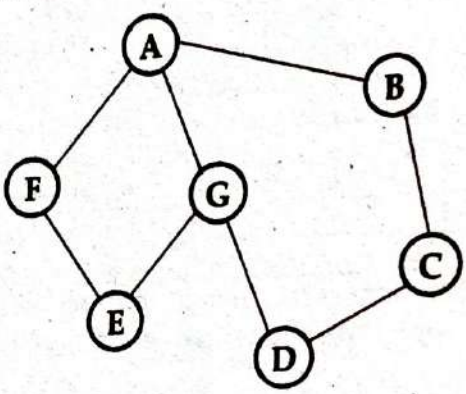
Pseudo code

Recursive steps for DFS are shown in below:

```
DFS (G, s)
{
T={s};
Traverse (s);
}
Traverse (v)
{
for each w adjacency to v and not yet in T
{
T=T U {w}; // put edge {v, tw} also
Traverse (w);
}
}
```

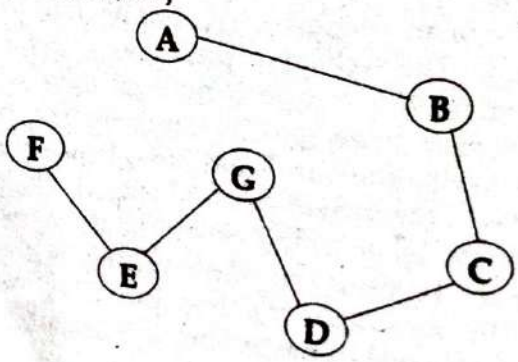
Tracing

The start vertex is v_0 = A



Set of vertices (L)	Stack (S)	Popped element of Stack (v)	Adjacent vertex (w)	Edge list (T)
A	A	.....	.....	.....
.....	.....	A	B	AB
A,B	B	B	C	AB, BC
A,B,C	C	C	D	AB,BC,CD
A,B,C,D	D	D	G	AB,BC,CD,DG
A,B,C,D,G	G	G	E	AB,BC,CD,DG,GE
A,B,C,D,G,E	E	E	F	AB,BC,CD,DG,GE,EF
A,B,C,D,G,E,F	F	F	.....	AB,BC,CD,DG,GE,EF
A,B,C,D,G,E,F	.....	.....	.....	AB,BC,CD,DG,GE,EF

The resulting BFS order of visitation is returned in the list L = (A, B, C, D, G, E, F), and the resulting DFS spanning tree is returned in the set T = {AB, BC, CD, DG, GE, EF}



TRIBHUVAN UNIVERSITY

Faculty of Humanities & Social Sciences

OFFICE OF THE DEAN

TU QUESTIONS-ANSWERS 2020

Bachelor in Computer Applications
Course Title: Data Structure & Algorithms
Course Code: CACS 201
Semester: III

Full Marks: 60
Pass Marks: 24
Time: 3 hr.

Candidates are required to answer the questions in their own words as far as possible.

Section A

Attempt all the questions. **(10 × 1 = 10)**

1. Circle (O) the correct answer.

i. Which of the following data structure are indexed structures?
   a) Linear arrays b) Linked list
   c) Graphs d) Trees

ii. Which of the following is an application of stack?
   a) Finding factorial b) Tower of Hanoi
   c) Solving matrix d) Infix to postfix conversion

iii. Queue is a .....
   a) FIFO b) LIFO
   c) Ordered list d) linear list

iv. Basic types of list are.....
   a) Statics and dynamic b) List and array
   c) Tree and graph d) Infix to postfix expression

v. General collection of node is called.....
   a) Stack b) Heap
   c) Linked list d) Pointer

vi. What is the space complexity of the recursion implementation to find factorial of a number?
   a) O (1) b) O(n)
   c) O (n^2) d) O(n^3)

vii. In a fully binary tree if there are L leaves, then the total number of nodes N is.....
   a) N=2 L b) N=L+1.
   c) N=L-1 d) L = 2*L-1

viii. The worst case complexity of bubble sort is.....
   a) O (n log n) b) O(log n)
   c) O (n) d) O(n^2)

ix. A technique for direct search is.....
   a) Binary search b) Linear search
   c) Tree search d) Hashing

x. The method of graph traversal are.....
   a) DFS and BFS b) MST
   c) BST d) MST and BST

Answer key

i. a	ii. b	iii. a	iv. b	v. c	vi. a	vii. d	viii. d	ix. d	x. a

Group B

[6x5 = 30]

Attempt any SIX questions.

2. What is data structure? Explain different operations to be performed on data structure.

Ans: The data structure is basically a technique of organizing and storing of different types of data items in computer memory. It is considered as not only the storing of data elements but also the maintaining of the logical relationship existing between individual data elements. It can also be defined as a mathematical or logical model, which relates to a particular organization of different data elements.

Thus, a data structure is the portion of memory allotted for a model, in which the required data can be arranged in a proper fashion. Data structure mainly specifies the following four things:

- Organization of data.
- Accessing methods
- Degree of associativity
- Processing alternatives for information

Operations on Data Structures

The basic operations that are performed on data structures are as follows:

- **Insertion:** Insertion means addition of a new data element in a data structure.
- **Deletion:** Deletion means removal of a data element from a data structure if it is found.
- **Searching:** Searching involves searching for the specified data element in a data structure.
- **Traversal:** Traversal of a data structure means processing all the data elements present in it.
- **Sorting:** Arranging data elements of a data structure in a specified order is called sorting.
- **Merging:** Combining elements of two similar data structures to form a new data structure of the same type, is called merging.

3. Define greedy algorithm and heuristic algorithm. Briefly explain Big-Oh notation. **[3+2]**

Ans: Greedy Algorithm

Greedy algorithms are mainly used for solving mathematical optimization problems. We either minimize or maximize the cost function corresponding to the given problem in optimization.

There are various types of methods to solve optimization problems. Greedy algorithms are the most used and simplest way to solve optimization problems.

A greedy algorithm divides a given problem into some stages. The main idea is to get an optimal result at each stage using heuristics. We use the solution of each stage as an input for the next stage and find the globally optimal solution.

A greedy algorithm doesn't guarantee to produce an optimal solution all the time, but it can give us a globally approximate solution of a given problem in efficient time.

Heuristic Algorithm

It's used to design the solutions to the problems as quickly as possible. It may not produce the best solution, but it'll give a near-optimal solution in a short time.

Heuristic algorithms are used to solve NP problems and decrease the time complexity of problems by giving quick solutions. It's popularly utilized in artificial intelligence problems. One example is informed search, where additional information is available to determine the next step towards finding the solution.

In the heuristic algorithm, a heuristic function gives the heuristic value to find the optimal solution. Each node has a heuristic value that is used to find the optimal path.

Big Oh (O) notation

When we have only asymptotic upper bound then we use O notation. If f and g are any two functions from set of integers to set of integers then function f(x) is said to be big oh of g(x) i.e. f(x)=O(g(x))) if and only if there exists two positive constants c and x0 such that for all x >= x0, f(x) <= c*g(x).

The above relation says that g(x) is an upper bound of f(x)

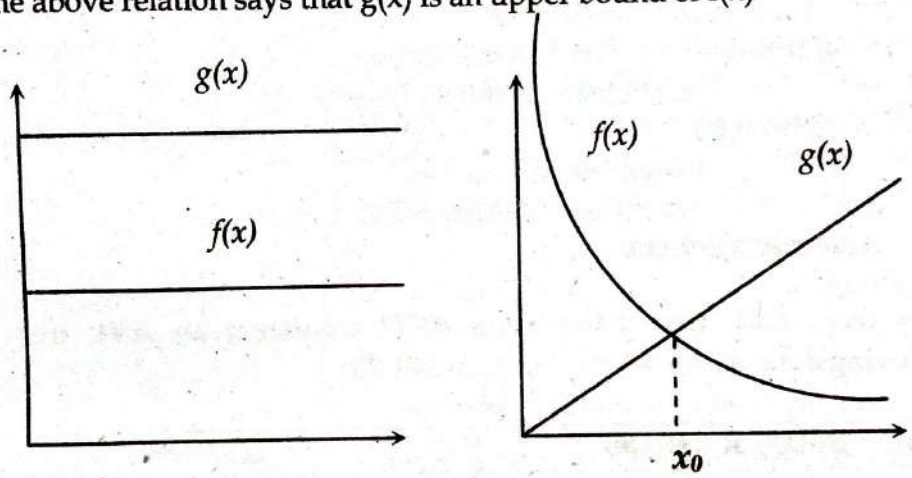


Fig: Geometric intrepretation of Big-Oh notation

Example: Find big oh of given function $f(n) = 3n^2 + 4n + 7$

Solution:

We have $f(n) = 3n^2 + 4n + 7 <= 3n^2 + 4n^2 + 7n^2 <= 14n^2$

$f(n) <= 14n^2$

where, c=14 and $g(n) = n^2$,

Thus $f(n) = O(g(n)) = O(n^2)$

4. What is circular queue? Write an algorithm to insert an item in circular queue.

Ans: A circular queue is one in which the insertion of a new element is done at very first location of the queue if the last location of the queue is full. When the rear part reaches at the last index of linear queue but front part is not at first index of the queue then in this case if we try to insert some elements, then according to the logic when **rear** is N-1 then it encounters an overflow situation. But there are some elements are left blank at the beginning part of the array. To utilize those left over spaces more efficiently, a circular fashion is implemented in queue representation. The circular fashion of queue reassigns the rear pointer with 0 if it reaches N-1 and beginning elements are free and the process is continued for deletion also. Such queues are called Circular Queue.

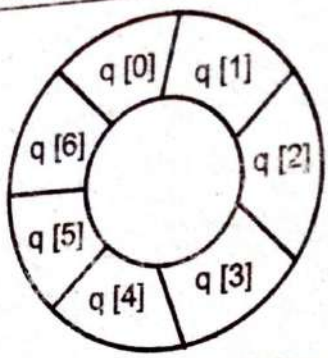


Fig: Circular queue with 7 data items

A circular queue overcomes the problem of unutilized space in linear queue implementation as array. In circular queue we sacrifice one element of the array thus to insert n elements in a circular queue we need an array of size n+1(or we can insert one less than the size of the array in circular queue).

Algorithms for inserting an element in a circular queue

This algorithm is assumed that rear and front are initially set to MAZSIZE-1.

1. Start.
2. Check queue full condition as,
   if (front==(rear+1)%MAXSIZE) then
   print Queue is full and exit
3. Otherwise
   Increment rear by 1 as,
   rear=(rear+1)%MAXSIZE;
4. cqueue[rear]=item;
5. Stop

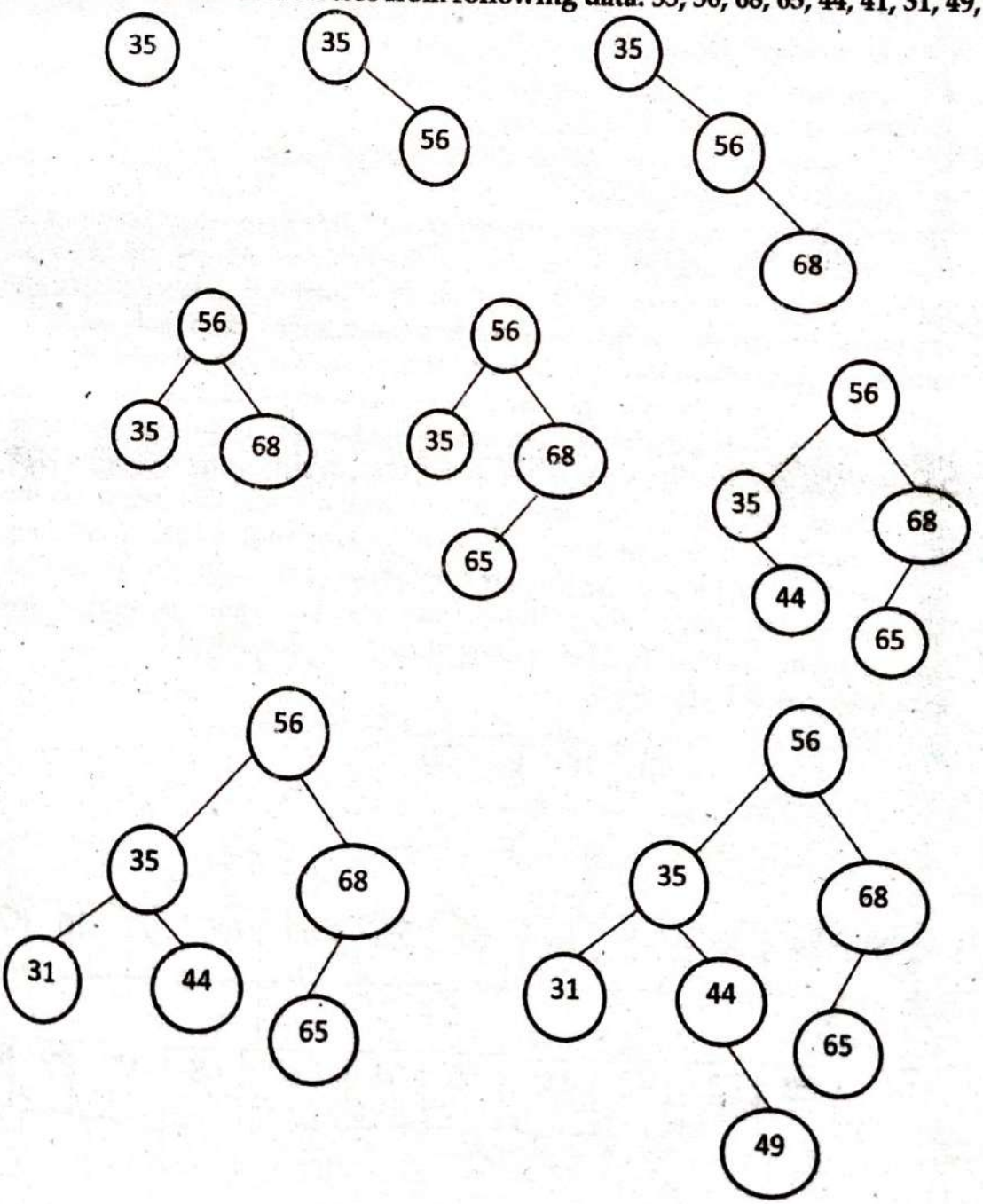
5. How does AVL tree differ from BST? Construct an AVL tree from following data: 35, 56, 68, 65, 44, 41, 31, 49, 20.

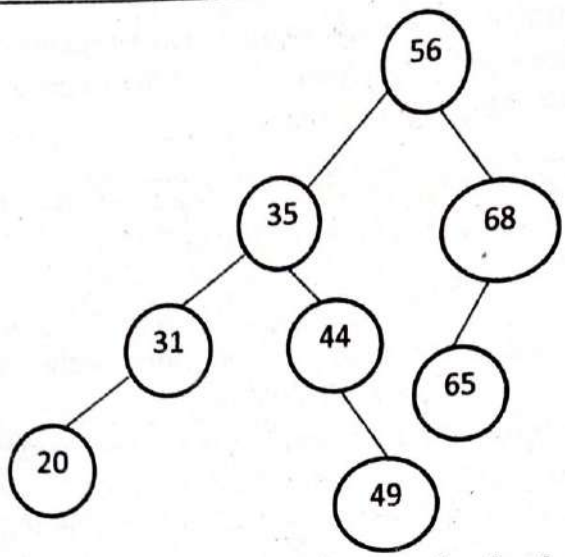
Ans: Difference between AVL and BST as follow,

Binary search tree	AVL tree
A binary Search Tree is a node-based binary tree data structure that has the following properties: • The left sub-tree of a node contains only nodes with keys lesser than the node's key. • The right sub-tree of a node contains only nodes with keys greater than the node's key. • The left and right sub-tree each must also be a binary search tree. • There must be no duplicate nodes.	AVL Tree is referred to as self - balanced or height-balanced binary search tree where the difference between heights of its left sub-tree and right sub-tree (Balance Factor) can't more than one for all nodes covered by a tree. We can say a tree is balanced if the balance factor of each node of a tree is in between -1 to 1; otherwise, a tree is considered as unbalanced and need to balance.
In binary search tree, the nodes based on binary tree contain left and right binary sub-tree.	AVL tree is also a binary tree because of two children.
Due to their ordered characteristics operation like insertion and deletion is faster.	They are usually unordered but the operations are still faster.

It is well organized and settled in terms of elements in the left sub-tree and right sub-tree greater then nodes.	Due to its height balance process it takes a little complexity within to get stable in both sub-trees.
The height or depth of the tree is O (n) where n is the number of nodes in the Binary Search tree.	The height or depth of the tree is denoted by O(log n).
Binary Search tree consists of three fields, left sub-tree, node value, and the right sub-tree.	AVL tree consists of four fields in nodes left sub-tree, node value, right sub-tree, and the balance factor.
Searching is slow and lag in binary search tree when there are large number of nodes available in the tree because the height is not balanced.	Faster searching is present in AVL tree even when there is large number of nodes in the tree because the height is balanced.

Construct an AVL tree from following data: 35, 56, 68, 65, 44, 41, 31, 49, 20





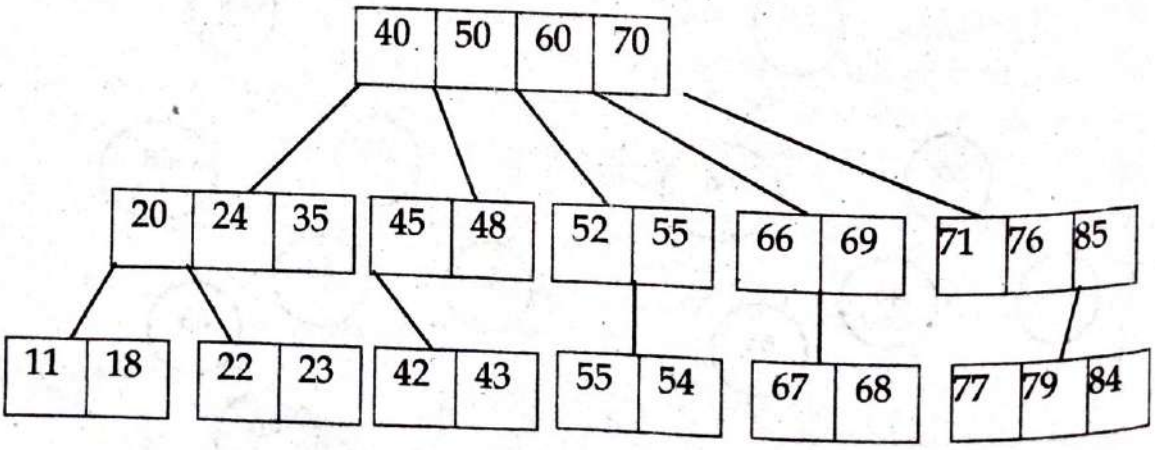
6. What is B-tree? Create a B- tree of order 4 using following data: 6. 4, 22, 10, 2, 14, 3, 8, 11, 13, 5, 9. [2+3]

Ans: A **B-tree of order m** is a multi-way search tree with the following properties:

- The root has at least two sub-trees unless it is a leaf.
- Each non-root and each non-leaf node holds $k - 1$ keys and k references to sub-trees where $\lceil m/2 \rceil \le k \le m$.
- Each leaf node holds $k - 1$ keys where $\lceil m/2 \rceil \le k \le m$.
- All leaves are on the same level

These conditions make the tree more balanced (and thus more efficient), and they simplify the insertion and deletion algorithms. B-trees are used as indexes for large data sets stored on disk. In a relational database, data are organized in separate sequences of records called tables. Each table could be stored as a sequential data file in which the records are numbered like the elements of an array. Or the database system might access the records directly by their disk addresses. Either way, each record is directly accessible on disk via some addressing scheme. So once we have the record's disk address, we can access it immediately (i.e., with a single disk read). So the "key" that is stored in the B-tree is actually a key/address pair containing the record's actual key value (e.g. an ISBN for books) together with its disk address. In the outline that follows, only the key value is shown, the accompanying disk address being understood to accompany it.

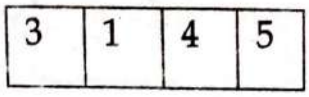
Example: A B-tree of order 5



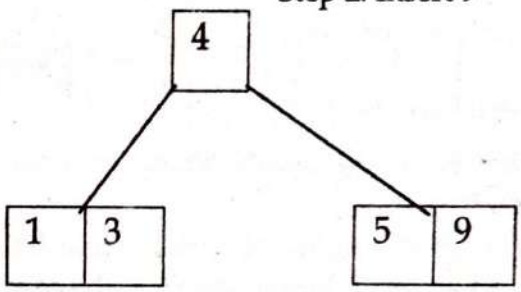
Example: Illustrate the growth of B -tree of order 5 inserting the keys 3, 1, 4, 5, 9, 2, 6, 8, 7, 11, 13, 19, 2, 23

Solution: Since the order of B-tree is 5, hence it may have at most 5 children and 4 keys and at least 3 children and 2 keys.

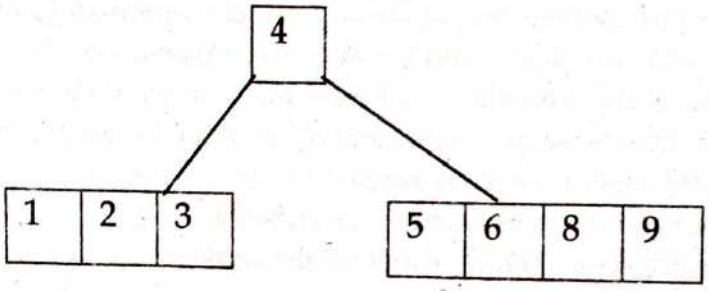
Step 1: Insert 3, 1, 4, 5



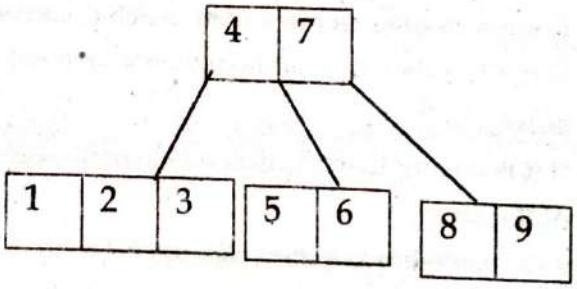
Step 2: Insert 9



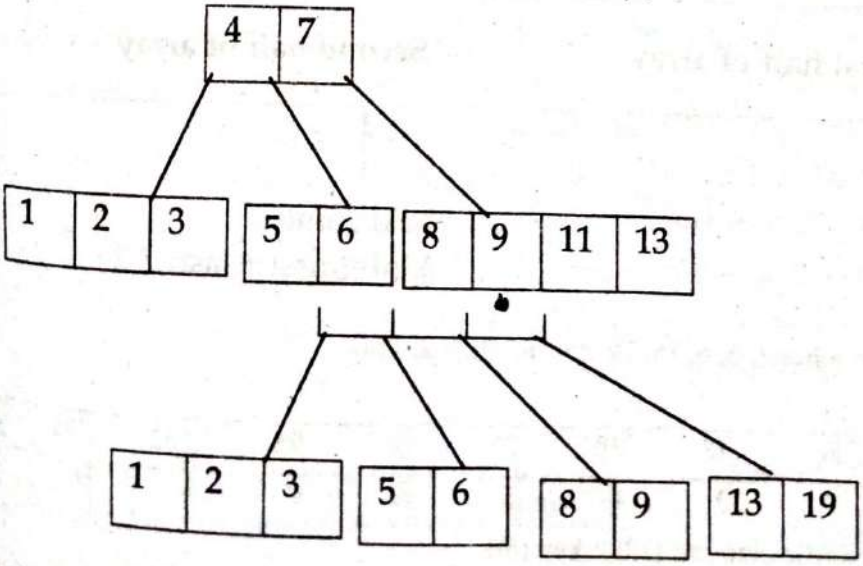
Step 3: Insert 2, 6, 8



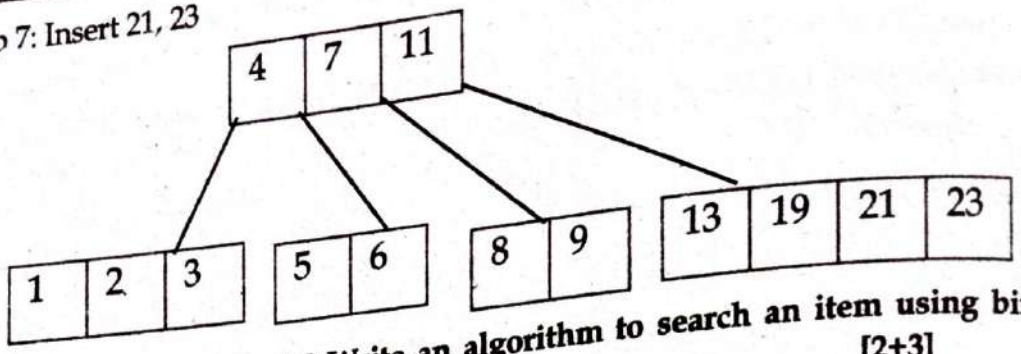
Step 4: Insert 7



Step 5: Insert 11, 13



Step 7: Insert 21, 23



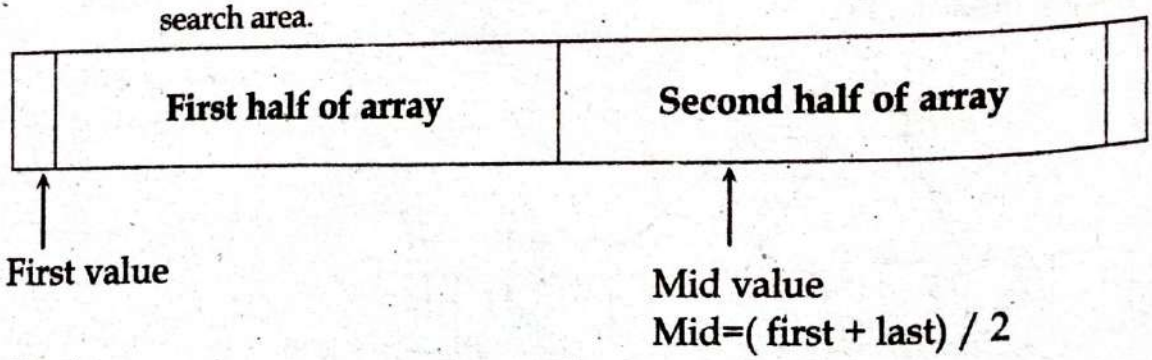
7. What is binary search? Write an algorithm to search an item using binary search. **[2+3]**

Ans: Binary Search is a searching algorithm for finding an element's position in a sorted array. Binary search is the search technique that works efficiently on sorted lists. Hence, to search an element into some list using the binary search technique, we must ensure that the list is sorted.

Binary search follows the divide and conquer approach in which the list is divided into two halves, and the item is compared with the middle element of the list. If the match is found then, the location of the middle element is returned. Otherwise, we search into either of the halves depending upon the result produced through the match.

The logic behind this technique is given below:

1. First find the middle element of the array
2. Compare the middle element with an item.
3. There are three cases:
   a. If it is a desired element then search is successful
   b. If it is less than desired item then search only the first half of the array.
   c. If it is greater than the desired element, search in the second half of the array.
4. Repeat the same process until element is found or exhausts in the search area.



Tracing

Search for key= 6 in {-1, 5, 6, 18, 19, 25, 46, 78, 102, 114}

Initially

-1	5	6	18	19	25	46	78	102	114
0	1	2	3	4	5	6	7	8	9

Step 1: Since [middle element (19) > key (6)]

1	5	6	18	19	25	46	78	102	114
0	1	2	3	4	5	6	7	8	9

Step 2: Since [middle element (5) < key (6)]

~~1~~	~~5~~	6	18	~~19~~	~~25~~	~~46~~	~~78~~	~~102~~	~~114~~
~~0~~	~~1~~	2	3	~~4~~	~~5~~	~~6~~	~~7~~	~~8~~	~~9~~

Step 1: Since [middle element (6) > key (6)]

~~1~~	~~5~~	6	~~18~~	~~19~~	~~25~~	~~46~~	~~78~~	~~102~~	~~114~~
~~0~~	~~1~~	2	~~3~~	~~4~~	~~5~~	~~6~~	~~7~~	~~8~~	~~9~~

Algorithm

1. Start
2. Read the search element from the user
3. Find the middle element in the sorted list
4. Compare, the search element with the middle element in the sorted list.
5. If both are matching, then display "Given element found!" and terminate the function
6. If both are not matching, then check whether the search element is smaller or larger than middle element.
7. If the search element is smaller than middle element, then repeat steps 2, 3, 4 and 5 for the left sub list of the middle element.
8. If the search element is larger than middle element, then repeat steps 2, 3, 4 and 5 for the right sub list of the middle element.
9. Repeat the same process until we find the search element in the list or until sub list contains only one element.
10. If that element also doesn't match with the search element, then display "Element not found in the list!" and terminate the function.
11. Stop

8. What is graph? Explain Kruskal's algorithm to construct minimum spanning tree with example.

Ans: Graph is a nonlinear data structure; it contains a set of points known as nodes (or vertices) and set of links known as edges (or Arcs) which connects the vertices. A graph is an ordered pair G = (V, E) comprising a set V of vertices or nodes together with a set E of edges or links. Each edge has either one or two vertices associated with it, called its end points. Each edge is a pair (v, w), where v, w ∈ V. Vertices are sometimes called nodes, and edges are sometimes called arcs. If the edge pair is ordered, the graph is called a **directed graph**. Directed graphs are sometimes called digraphs. In a digraph, vertex w is adjacent to vertex v if and only if (v, w) ∈ E. Sometimes an edge has a third component, called the edge cost (or weight) that measures the cost of traversing the edge.

Example: A simple undirected graph with 7 vertices and 11 edges

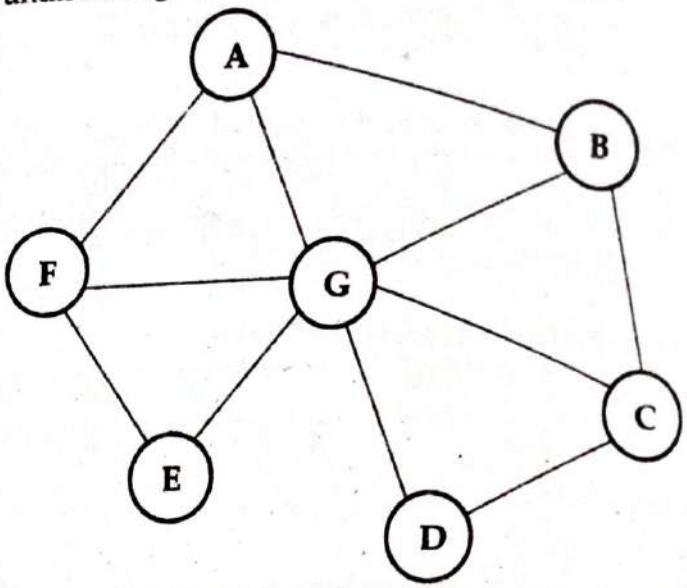


Fig: Undirected graph

Kruskal's algorithm

Kruskal's algorithm is a minimum spanning tree algorithm that takes a graph as input and finds the subset of the edges of that graph which:

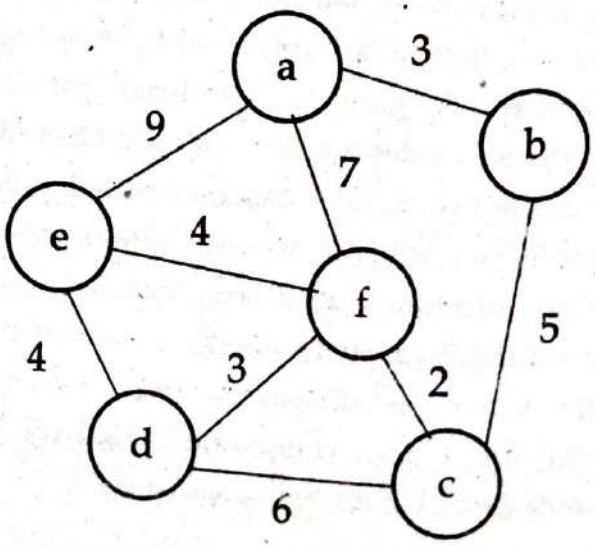
- form a tree that includes every vertex
- has the minimum sum of weights among all the trees that can be formed from the graph

It is the procedure for producing a minimum spanning tree of a given weighted graph that successively adds edges of least weight that are not already in the tree such that no edges produce a simple circuit when it is added.

Algorithm

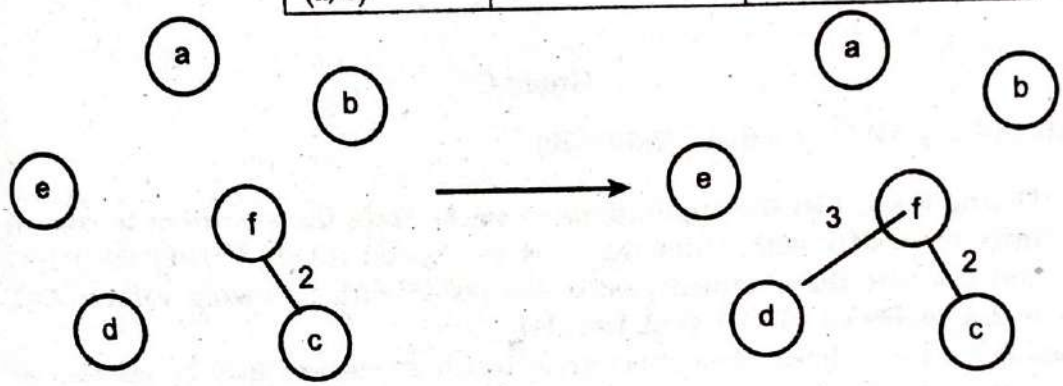
1. Start
2. Sort all the edges from low weight to high
3. Take the edge with the lowest weight and add it to the spanning tree. If adding the edge created a cycle, then reject this edge.
4. Keep adding edges until we reach all vertices.
5. Stop

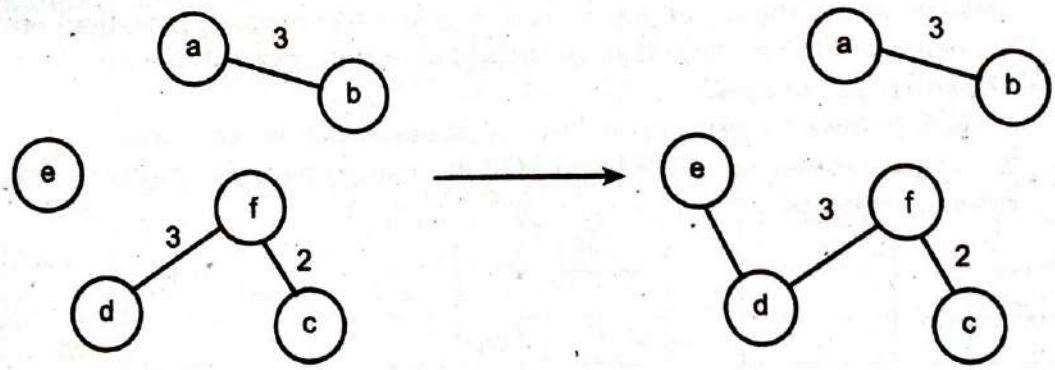
Example: Find minimum spanning tree of given graph by using Kruskal's algorithm.

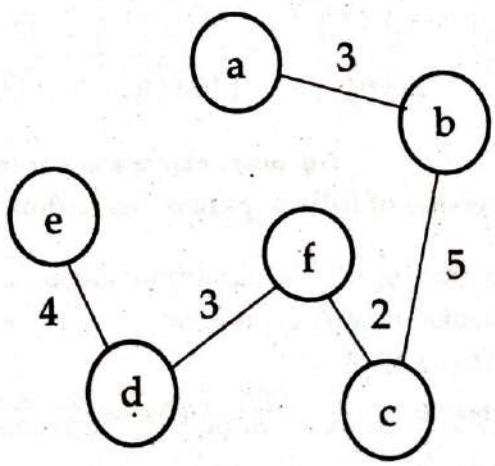


Solution: Edges in sorted order are given below:

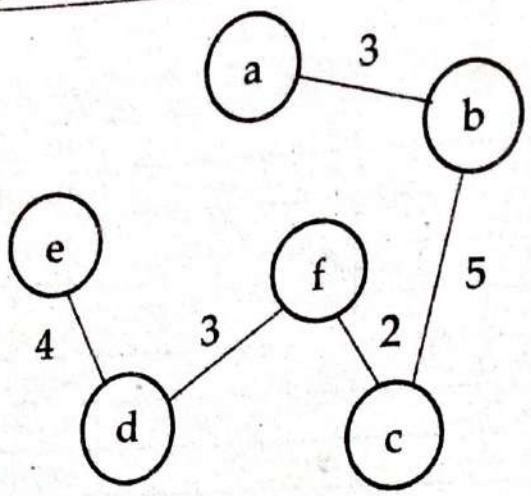
Edges	Cost	Action
(f, c)	2	Accept
(f, d)	3	Accept
(a, b)	3	Accept
(d, e)	4	Accept
(b, c)	5	Accept
(d, c)	6	Reject
(a, f)	7	Reject
(a, e)	9	Reject







The edges (d, c), (a, f) and (a, e) forms cycle so discard these edges from the tree. Thus the minimum spanning tree of weight 17 is;



Group C

Attempt any TWO questions. [2x10 = 20]

1. **Define stack. List the applications of stack. Trace the algorithm to convert infix to postfix with following infix expression ((A+B)-C*D/E)*(H-I)*F+G and evaluate the obtained postfix expression with following values: A=4, B=2, C=4, D=3, E=8, F=2, G=3, H=5, I=1**

Ans: A stack is a linear data structure in which an element may be inserted or deleted only at one end called the top end of the stack i.e. the elements are removed from a stack in the reverse order of that in which they were inserted into the stack. Stack uses a variable called top which points topmost element in the stack. The top is incremented while pushing (inserting) an element in to the stack and decremented while popping (deleting) an element from the stack.

A stack follows the principle of last-in-first-out (LIFO) system. According to the stack terminology, PUSH and POP are two terms used for insert and delete operations.

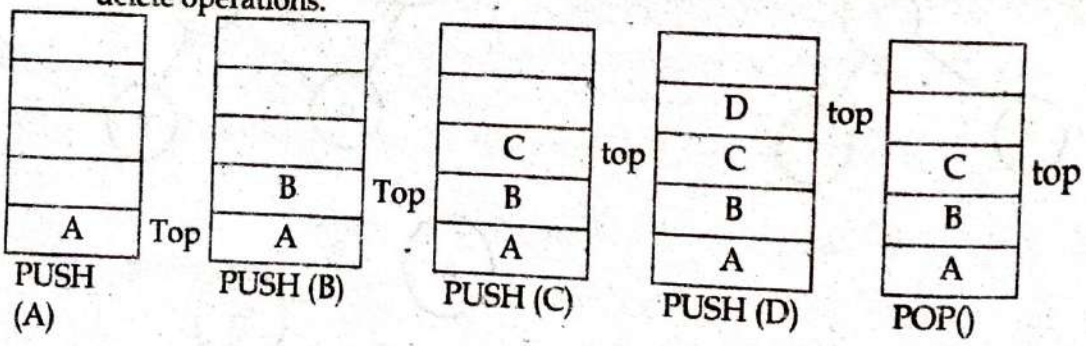


Fig: push, pop operations in Stack

Trace of Conversion of infix to postfix Algorithm

The following tracing of the algorithm illustrates convert infix to postfix the algorithm. Consider an infix expression

((A+B)-C*D/E)*(H-I)*F+G

Scan character	Poststack	Opstack
(	.....	(
(	.....	((
A	A	((

+	A	((+
B	AB	((+
)	AB+	(
-	AB+	(-
C	AB+C	(-
*	AB+C	(- *
D	AB+CD	(-*
/	AB+CD*	(- /
E	AB+CD*E	(- /
)	AB+CD*E / -	.....
*	AB+CD*E / -	*
(	AB+CD*E / -	* (
H	AB+CD*E / - H	* (
-	AB+CD*E / - H	* (-
I	AB+CD*E / - H I	*(-
)	AB+CD*E / - H I -	*
*	AB+CD*E / - H I - *	*
F	AB+CD*E / - H I - * F	*
+	AB+CD*E / - H I - * F *	+
G	AB+CD*E / - H I - * F * G	+
------	AB+CD*E / - H I - * F * G +	----------
.....	AB+CD*E / - H I -* F * G + (postfix)	.....

Evaluate the obtained postfix expression AB+CD*E / - H I - * F * G + with following values: A=4, B=2, C=4, D=3, E=8, F=2, G=3, H=5, I=1

Scanned character	Value	Op2	Op1	Result	vstack
A	4	.....	.....	.....	4
B	2	.....	.....	.....	4, 2
+	-------	2	4	6	6
C	4	.....	.....	.....	6, 4
D	3	.....	.....	.....	6, 4, 3
*	.....	3	4	12	6, 12
E	8	.....	.....	.....	6, 12, 8
/	.....	8	12	1	6, 1
-	.....	1	6	5	5
H	5	.....	.....	.....	5, 5
I	1	.....	.....	.....	5, 5, 1
-	.....	1	5	4	5, 4
I	1	.....	.....	.....	5, 4, 1
-	.....	1	4	3	5, 3
*	.....	3	5	15	15
F	2	.....	.....	.....	15, 2
*	....	2	15	30	30
G	3	.....	.....	.....	30, 3
+	.....	3	30	33	33

The final evaluated value is 33

2. What is double linked list? How does it differ from circular linked list? Write an algorithm or function to add a node at the beginning and end of doubly linked list. **[1 +1+4+ 4]**

Ans: A linked list in which all nodes are linked together by multiple numbers of links i.e. each node contains three fields (two pointer fields and one data field) rather is called doubly linked list. It provides bidirectional traversal. Doubly circular linked list can be conceptualized as two singly linked lists formed from the same data items, but in opposite sequential orders.

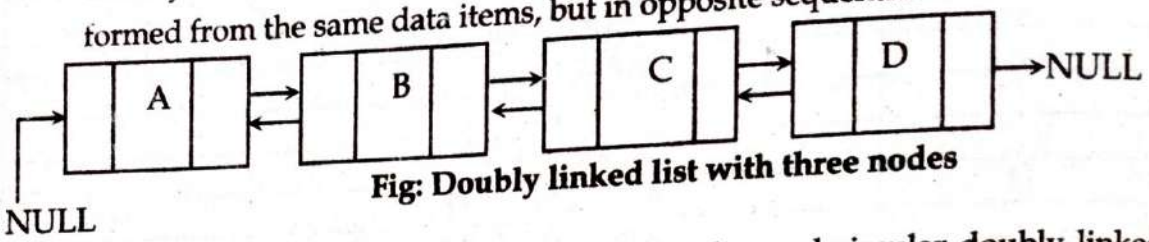


Fig: Doubly linked list with three nodes

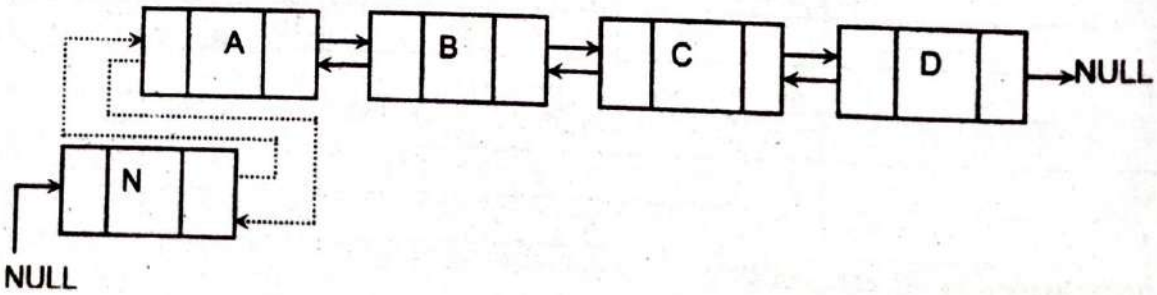
The main difference between doubly linked list and circular doubly linked list is that in doubly linked list the pointer field of last node contains NULL pointer whereas in circular linked list the pointer field of last node contains the address of first node and vice versa.

Representation of doubly linked list

```
struct node
{
        int info;
        struct node *prev;
        struct node *next;
};
typedef struct node NodeType;
NodeType *first=NULL;
NodeType *last=NULL;
```

Algorithm to insert a node at the beginning of a doubly linked list

1. Start
2. Create a new node by using malloc function as,
   Newnode=(NodeType*)malloc(sizeof(NodeType))
3. Read data item to be inserted say it be 'el'
4. Set Newnode→info=el
5. Set Newnode→prev=Newnode→next=null
6. If first==null then
   Set, first=last=Newnode
7. Otherwise,
   a. Set Newnode→next=first
   b. Set first→prev=Newnode
   c. Set first=Newnode
8. Stop



Algorithm to insert a node at the end of a doubly linked list

1. Start
2. Create a new node by using malloc function as,

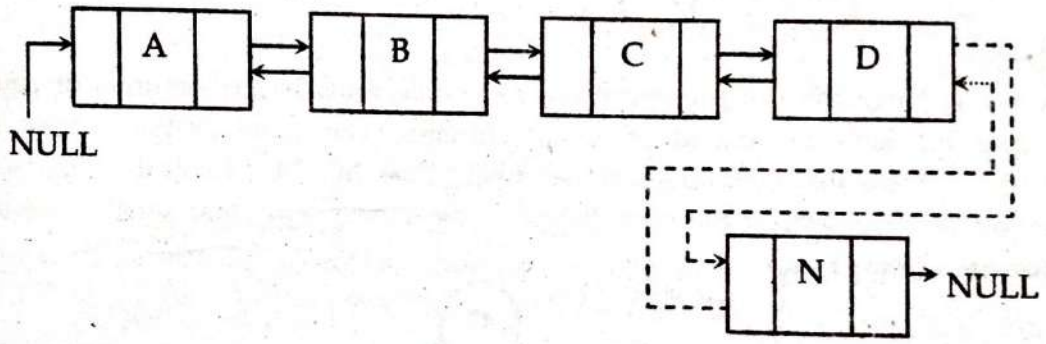
   Newnode=(NodeType*)malloc(sizeof(NodeType))
3. Read data item to be inserted say it be 'el'
4. Set Newnode→info=el
5. Set Newnode→next=NULL
6. If first==NULL then

   Set, first=last=Newnode
7. Otherwise,

   a. Set last→next=Newnode

   b. Set Newnode→prev=last

   c. Set last=Newnode
8. stop



3. What is heap? Differentiate between min heap and max heap. Sort the following data in ascending order by heap sort method: 2, 9, 3, 12, 15, 8, 11 [2+2+6]

Ans: A heap is an almost complete binary tree of n nodes such that the value of each node is less than or equal to the value in parent node. This type of heap is called max heap. By default, the heap is max heap. There are two types of heap:

1. Max heap and
2. Min heap

Example: Construct a heap from a set of 6 elements {15, 19, 10, 7, 17, 16}

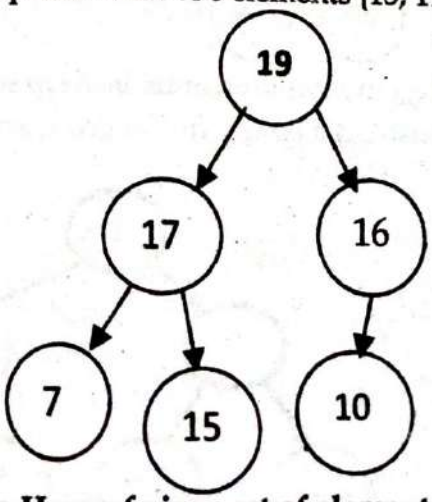
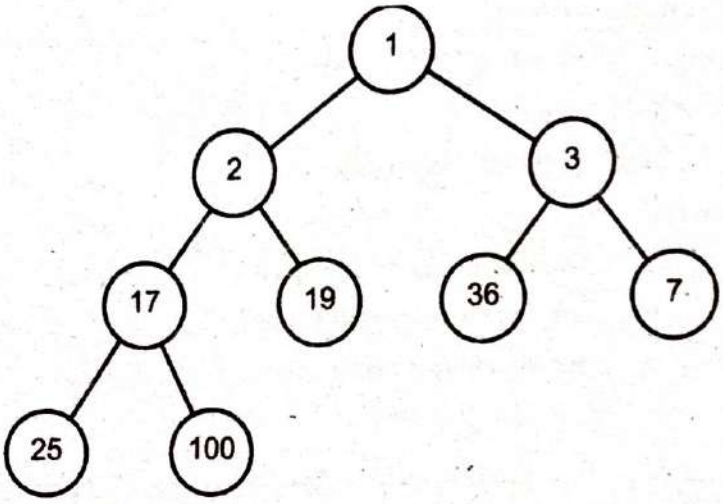


Fig Heap of given set of elements

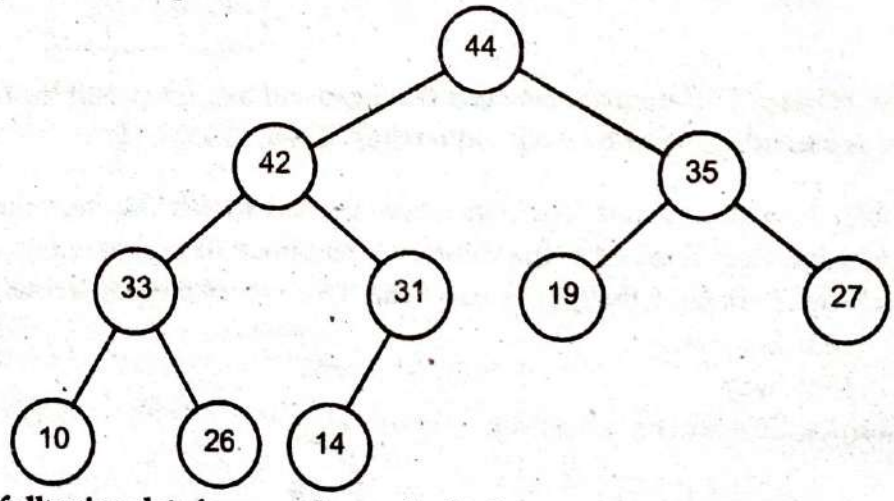
Min-Heap

In a Min-Heap the key present at the root node must be less than or equal among the keys present at all of its children. The same property must be recursively true for all sub-trees in that Binary Tree. In a Min-Heap the minimum key element present at the root. Below is the Binary Tree that satisfies all the property of Min Heap.



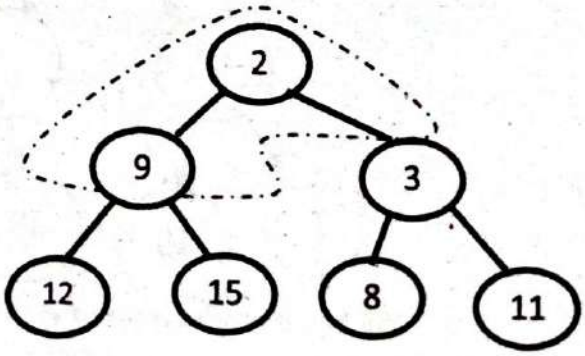
Max Heap

In a Max-Heap the key present at the root node must be greater than or equal among the keys present at all of its children. The same property must be recursively true for all sub-trees in that Binary Tree. In a Max-Heap the maximum key element present at the root. Below is the Binary Tree that satisfies all the property of Max Heap.

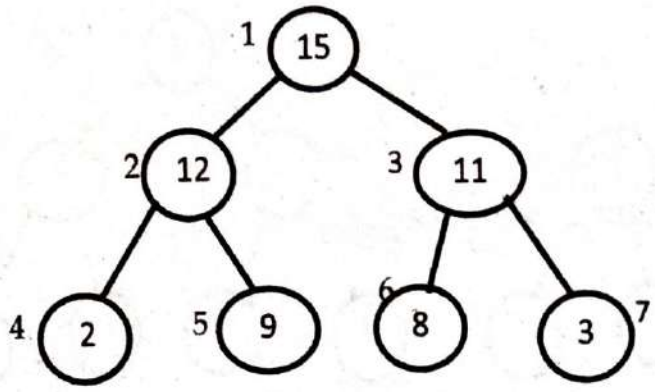


Sort the following data in ascending order by heap sort method: 2, 9, 3, 12, 15, 8, 11

Solution: At first construct a binary tree of given array,

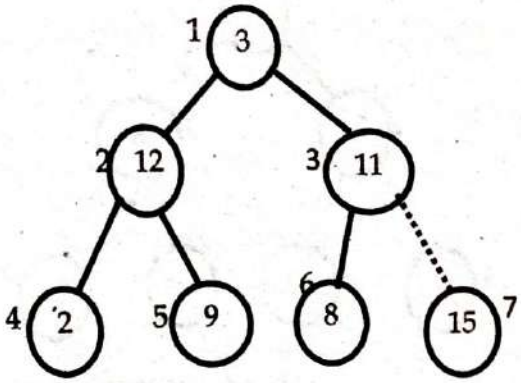


Now construct a heap of given tree as,

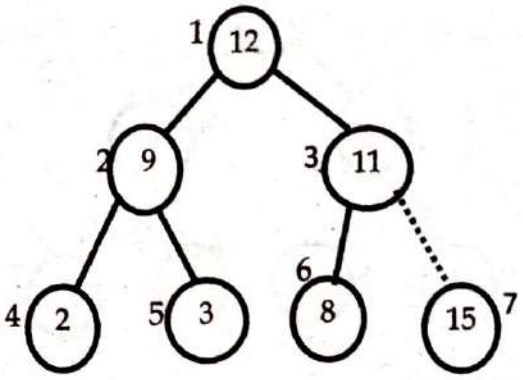


Heap sort

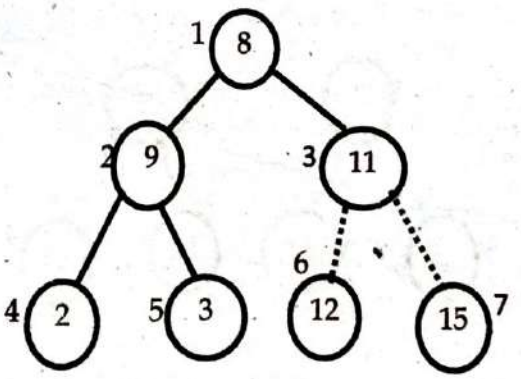
Swap (15, 3)



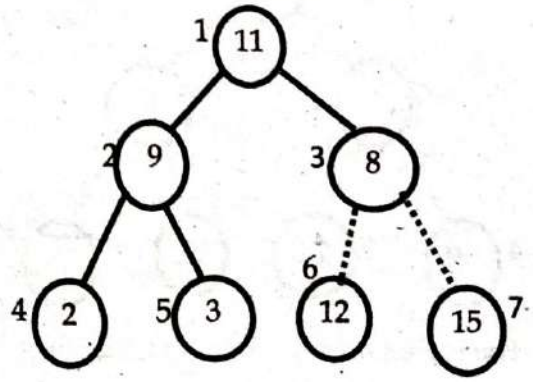
Heapify at root



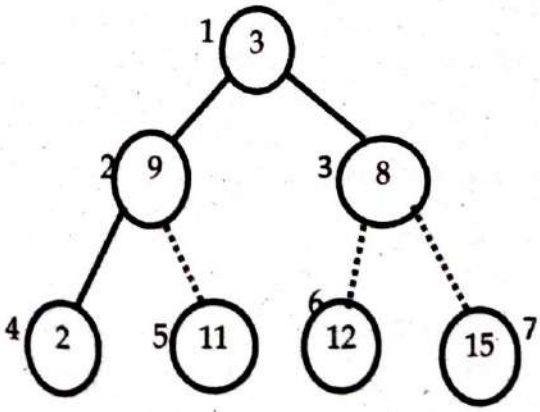
Swap (12, 8)



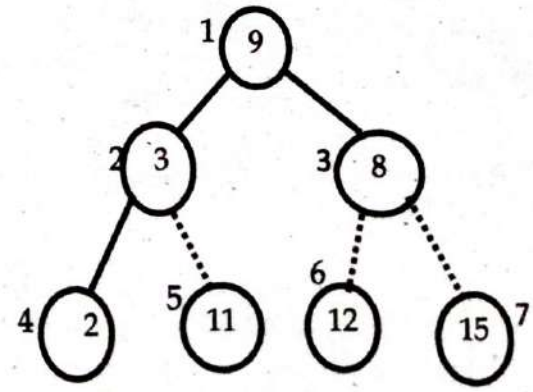
Heapify at root



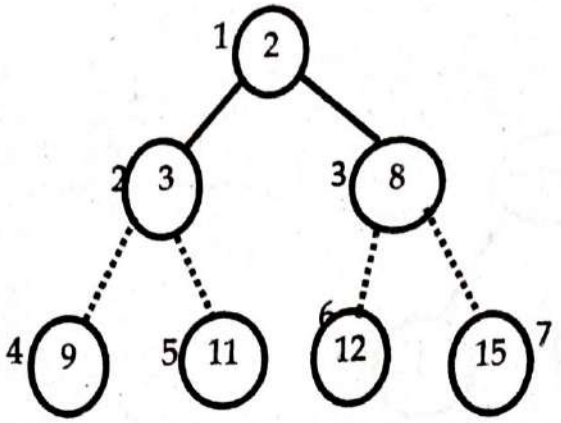
Swap (11, 3)



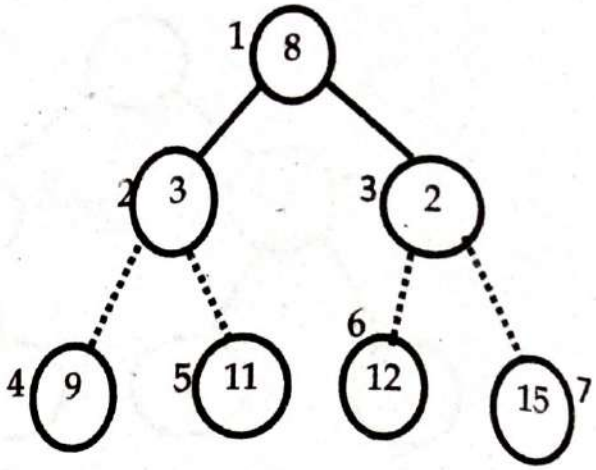
Heapify at root



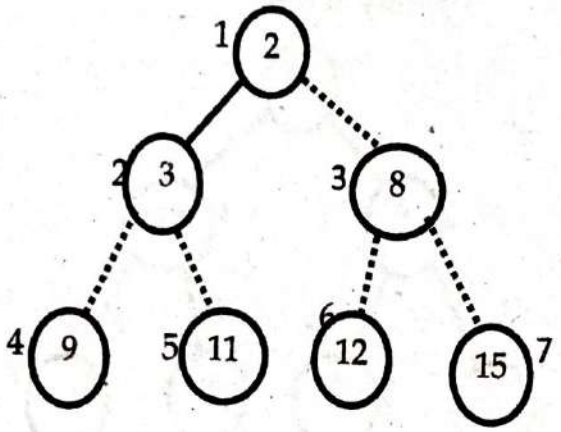
Swap (9, 2)



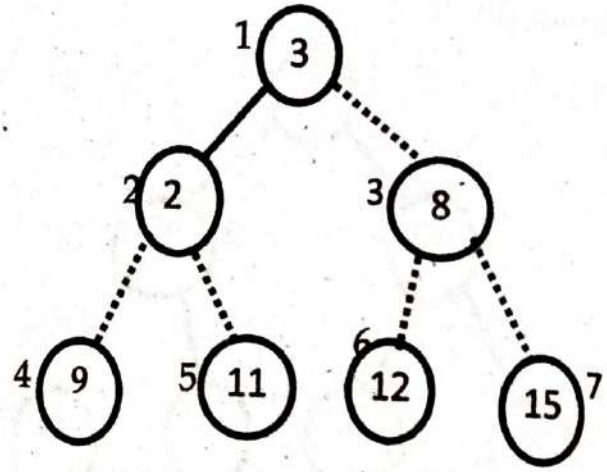
Heapify at root



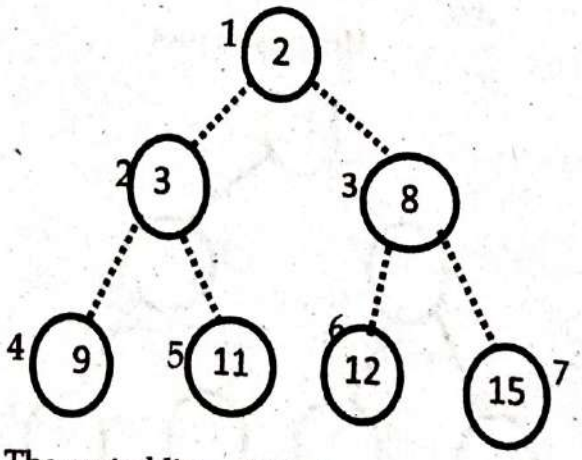
Swap (8, 2)



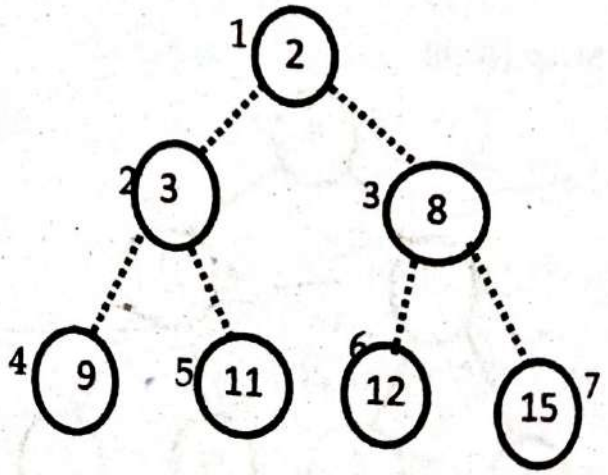
Heapify at root



Swap (3, 2)



Heapify at root



The sorted list = {2, 3, 8, 9, 11, 12, 15}

MODEL QUESTIONS SETS FOR PRACTICE

MODEL SET 1

Bachelor in Computer Applications **Full Marks:** 60
Course Title: Data Structure & Algorithms **Pass Marks:** 24
Course Code: CACS 201 **Time:** 3 hr.
Semester: III

Candidates are required to answer the questions in their own words as far as possible.

Section A

Attempt all the questions. **(10 × 1 = 10)**

1. Circle (O) the correct answer.

i) Which of the following data structure is linear type?
a) Graph b) Trees
c) Binary tree d) Stack

ii) When does top value of the stack changes?
a) Before deletion b) While checking underflow
c) At the time of deletion d) After deletion

iii) What is a hash function?
a) A function has allocated memory to keys
b) A function that computes the location of the key in the array
c) A function that creates an array
d) None of the mentioned

iv) In the analysis of algorithms, what plays an important role?
a) Text Analysis b) Growth factor
c) Time d) None of the above

v) Which of the following is not an advantage of trees?
a) Hierarchical structure
b) Faster search
c) Router algorithms
d) Undo/Redo operations in a notepad

vi) In linked list each node contain minimum of two fields. One field is data field to store the data second field is?
a) Pointer to character b) Pointer to integer
c) Pointer to node d) Node

vii) The Data structure used in standard implementation of Breadth First Search is?
a) Stack b) Queue
c) Linked List d) None of the mentioned

viii) A normal queue, if implemented using an array of size MAX_SIZE, gets full when
a) Rear=MAX_SIZE-1 b) Front=(rear+1)mod MAX_SIZE
c) Front=rear+1 d) Rear=front

ix) Which of the following sorting algorithms is used along with quick sort to sort the sub arrays?
a) Merge sort
b) Shell sort
c) Insertion sort
d) Bubble sort

x) Which of the following are the operations applicable a primitive data structures?
a) create
b) destroy
c) update
d) all of the above

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. What do you mean by all pair shortest path problem? Describe Floyd Warshall algorithm.
3. What is stable sort? List out any two stable sorting techniques with example.
4. What is queue? What are main drawbacks of linear queue over circular queue?
5. What do you mean by rotation operation in AVL tree?
6. What is stack? How it is differ from queue? Show that stack and queue as ADT.
7. Draw a hash table with open addressing and a size of 9. Use the hash function "k%9". Insert the keys: 5, 29, 20, 0, 27 and 18 into your table (in that order).
8. Mention how to insert a new node in linked list where free node will be available?

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. What is use of Huffman algorithm? Explain Huffman algorithm with suitable example.
10. What is linear queue? How it is differ from priority queue? Write down algorithms for enqueue and dequeue operation for linear queue.
11. What is doubly linked list? How it is differ from singly linked list? Describe deletion of node from DLL.

MODEL SET 2

Section A

Attempt all the questions. **(10 × 1 = 10)**

1. **Circle (O) the correct answer.**

i) Prefix notation is also known as.....
a) Reverse Polish Notation
b) Reverse Notation
c) Polish Reverse Notation
d) Polish Notation

ii) A circular linked list can be used for
a) Stack
b) Queue
c) Both Stack & Queue
d) Neither Stack or Queue

iii) Binary search tree has best case run-time complexity of O(log n). What could the worst case?
a) O(n)
b) $O(n^2)$
c) $O(n^3)$
d) None of the above

iv) Graph traversal is different from a tree traversal, because
   a) trees are not connected.
   b) graphs may have loops.
   c) trees have root.
   d) None is true as tree is a subset of graph.

v) Which of the below given sorting techniques has highest best-case runtime complexity
   a) quick sort b) selection sort
   c) insertion sort d) bubble sort

vi) Which of the following uses memoization?
   a) Greedy approach b) Divide and conquer approach
   c) Dynamic programming approach d) None of the above!

vii) Tower of hanoi is a classic example of
   a) divide and conquer b) recursive approach
   c) B but not A d) Both A & B

viii) A priori analysis of an algorithm assumes that –
   a) the algorithm has been tested before in real environment.
   b) all other factors like CPU speed are constant and have no effect on implementation.
   c) the algorithm needs not to be practical.
   d) none of the above.

ix) A mathematical-model with a collection of operations defined on that model is called
   a) Data Structure b) Abstract Data Type
   c) Primitive Data Type d) Algorithm

x) A linear collection of data elements where the linear node is given by means of pointer is called
   a) linked list b) node list
   c) primitive list d) None of these

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. Define Binary Tree. Write on algorithm to implement different tree traversal techniques.
3. Write an algorithm for merge sort and comment on its complexity.
4. Hash the following in a table of size 11. Use any two collision resolution technique.
   99 67 41 0 17 2 98 20 94 27
5. Explain Huffman Algorithm. Construct Huffman tree for "MAHARASHTRA" with its optimal code
6. What is heuristic algorithm? How it is differ from approximation algorithm? Explain.
7. What are the application areas of priority queue? Show that priority queue act as an ADT.
8. Evaluate following postfix expressions by using stack:
   A B - C D E F / + G - * - H -
   Where, A = 4, B = 8, C = 2, D = 5, E = 6, F = 9, G = 1, H = 3

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. Write a program to implement Quick sort and show the steps to sort the following elements by Quick sort method:
   19, 27, 5, 9, 86, 4, 5

10. What do you mean by postfix expression? Trace the algorithm to convert following infix expression to their equivalent postfix expression by using stack.
A/B*(C$D+E*F) + (G*H/I)

11. What are the advantages of linked list over array? How to create node in circular linked list? Write down algorithm for inserting node to circular linked list.

MODEL SET 3

Section A

Attempt all the questions. **(10 × 1 = 10)**

1. Circle (O) the correct answer.

i) Representation of data structure in memory is known as:
a) recursive b) abstract data type
c) storage structure d) file structure

ii) Which of the following is not the internal sort?
a) Insertion sort b) Bubble sort
c) Merge sort d) Heap sort

iii) What will be the value of top, if there is a size of stack is 5?
a) 5 b) 4
c) 3 d) 6

iv) .....is not the operation can be performed on queue.
a) Insertion b) Deletion
c) Retrieval d) Traversal

v) Which if the following is/are the levels of implementation of data structure
a) Abstract level b) Application level
c) Implementation level d) All of the above

vi) Which of the following is not the part of ADT description?
a) Data b) Operations
c) Both of the above d) None of the above

vii) . . . Is a pile in which items are added at one end and removed from the other.
a) Stack b) Queue
c) List d) None of the above

viii) The number of comparisons done by sequential search is .....
a) (N/2)+1 b) (N+1)/2
c) (N-1)/2 d) (N+2)/2

ix) In a circular queue the value of r will be ...
a) r=r+1 b) r=(r+1)% [QUEUE_SIZE – 1]
c) r=(r+1)% QUEUE_SIZE d) r=(r-1)% QUEUE_SIZE

x) A ..... is a linear list in which insertions and deletions are made to from either end of the structure.
a) Circular queue b) random of queue
c) Priority d) dequeue

Group B

Attempt any SIX questions. [6x5 = 30]

2. What is main problem of linear queue over circular queue? Write down Enqueue algorithm for circular queue.
3. What are the application areas of stack? Write down TOH algorithm and also trace the algorithm for n=3.
4. What do you mean by evaluation of postfix expression? Trace the algorithm to evaluate following postfix expression by using stack.
   AB/C+D$EF*G/H+I+$
5. Define stack as an ADT. Write down PUSH and POP algorithms of stack.
6. What do you mean by traversal of tree? Define BST and also show insertion and deletion process of node to binary tree with example.
7. Define representation of graph? Define Kruskal's algorithm for finding minimum spanning tree of given graph.
8. What do you mean by traversal of tree? Define DFS and BFS with suitable example.

Group C

Attempt any TWO questions. [2x10 = 20]

9. How can you define heap? Sort following data items by using heap sort:
   A[ ] = { 4, 3, 22, 87, 56, 90, 11, 9}
10. What do you mean by linked list? Define types of linked list and write down insertion and deletion algorithms of doubly linked list.
11. How can you define internal sort and external sort? Describe quick sort and merge sort technique with suitable example.

MODEL SET 4

Candidates are required to answer the questions in their own words as far as possible.

Section A

Attempt all the questions. (10 × 1 = 10)

1. Circle (O) the correct answer.

i) In a priority queue, insertion and deletion takes place at .....
   a) front, rear end b) only at rear end
   c) only at front end d) any position

ii) The time complexity of quick sort is .....
   a) O(n) b) O(n2)
   c) O(n log n) d) O(log n)

iii) The data structure which is one ended is.....
   a) queue b) stack
   c) tree d) graph

iv) A list which displays the relationship of adjacency between elements is said to be
   a) linear b) non linear
   c) linked list d) trees

v) The Data structure used in standard implementation of Breadth First Search is?
   a) Stack b) Queue
   c) Linked List d) None of the mentioned

vi) What is the value of the postfix expression 6 3 2 4 + – *:

a) 1 b) 40

c) 74 d) -18

vii) What is direct addressing?

a) Distinct array position for every possible key

b) Fewer array positions than keys

c) Fewer keys than array positions

d) None of the mentioned

viii) Which of the following data structures are indexed structures?

a) Linear arrays b) Linked lists

c) Graphs d) Trees

ix) A queue is a.....

a) FIFO (First In First Out) list b) LIFO (Last In First Out) list.

c) Ordered array d) Linear tree

x) Which of the following is not an advantage of trees?

a) Hierarchical structure

b) Faster search

c) Router algorithms

d) Undo/Redo operations in a notepad

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. Define stack as an ADT. Write down PUSH and POP algorithms of stack.
3. What do you mean by hash collision? Define linear probing and quadratic probing hash collision resolving techniques with suitable example.
4. Convert following infix expression to their equivalent postfix expression, (A+B-J*K/L)/(C*D-E$F)*G+H-I
5. What is main concept behind priority queue? Write down **Enqueue** and **Dequeue** algorithm of priority queue.
6. What is recursion? Define recursive algorithm for finding n^{th} term of Fibonacci series.
7. Write an algorithm to insert a new node at the middle of doubly linked list.
8. What is dynamic memory allocation? Explain DMA with suitable example.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. What do you mean by traversal of tree? Define BST and also show insertion and deletion process of node to binary tree with example.
10. Define representation of graph? Define Kruskal's algorithm for finding minimum spanning tree of given graph.
11. What do you mean by circular list? Define types of linked list and write down insertion and deletion algorithms of circular doubly linked list.

MODEL SET 5

Section A

Attempt all the questions. **(10 × 1 = 10)**

1. Circle (O) the correct answer.

i) Arrays are best data structures.....

a) for relatively permanent collections of data

b) for the size of the structure and the data in the structure are constantly changing

c) for both of above situation

d) for non of above situation

ii) Process of inserting an element in stack is called _____

a) Create b) Push

c) Evaluation d) Pop

iii) In the array implementation of circular queue, which of the following operation take worst case linear time?

a) Insertion b) Deletion

c) To empty a queue d) None

iv) What is the number of edges present in a complete graph having n vertices?

a) (n*(n+1))/2 b) (n*(n-1))/2

c) n d) Information given is insufficient

v) In a full binary tree if there are L leaves, then total number of nodes N is?

a) N = 2*L b) N = L + 1

c) N = L - 1 d) N = 2*L - 1

vi) What can be the techniques to avoid collision?

a) Make the hash function appear random

b) Use the chaining method

c) Use uniform hashing

d) All of the mentioned

vii) Which of the following is not a type of Linked List?

a) Doubly Linked List b) Circular Linked List

c) Singly Linked List d) Hybrid Linked List

viii) The time factor when determining the efficiency of algorithm is measured by counting

a) Microseconds b) The number of key operations

c) The number of statements d) the kilobytes of algorithm

ix) Which of the following methods is the most effective for picking the pivot element?

a) first element b) last element

c) median-of-three partitioning d) random element

x) What is a full binary tree?

a) Each node has exactly zero or two children

b) Each node has exactly two children

c) All the leaves are at the same level

d) Each node has exactly one or two children

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. How can you define searching? Describe sequential and binary search techniques with suitable example. Also analyze them.
3. How can you define balance factor of AVL tree? Write down insertion and deletion process of AVL tree.
4. What RAM model? Define big oh and big omega and big theta notations with suitable example.
5. How recursions differ from iterative algorithms? Define recursive algorithm for finding sum of n- natural numbers.
6. How can you define heap? Sort following data items by using heap sort: A[ ] = { 14, 93, 22, 87, 56, 90, 11, 90}
7. Define Huffman algorithm to show the compression of file with suitable example.
8. What is ADT? Describe linked list as an ADT.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. What is graph? Define types of graph. Describe DFS and BFS graph traversal methods with suitable examples.
10. What do you mean by linked list? Define types of linked list and write down insertion and deletion algorithms of doubly linked list.
11. How can you define internal sort and external sort? Describe quick sort and merge sort technique with suitable example.

MODEL SET 6

Section A

Attempt all the questions.

1. **Circle (O) the correct answer.** **(10 × 1 = 10)**

i) The time factor when determining the efficiency of algorithm is measured by

a) Counting microseconds

b) Counting the number of key operations

c) Counting the number of statements

d) Counting the kilobytes of algorithm

ii) Which of the following case does not exist in complexity theory?

a) Best case

b) Worst case

c) Average case

d) Null case

iii) The complexity of Bubble sort algorithm is

a) O(n)

b) O(log n)

c) O(n2)

d) O(n log n)

iv) Which of the following data structure is linear data structure?
a) Trees b) Graphs
c) Arrays d) None of above

v) The operation of processing each element in the list is known as
a) Sorting b) Merging
c) Inserting d) Traversal

vi) Finding the location of the element with a given value is:
a) Traversal b) Search
c) Sort d) None of above

vii) The elements of an array are stored successively in memory cells because
a) by this way computer can keep track only the address of the first element and the addresses of other elements can be calculated
b) the architecture of computer memory does not allow arrays to store other than serially
c) both of above
d) none of above

viii) Linked lists are best suited
a) for relatively permanent collections of data
b) for the size of the structure and the data in the structure are constantly changing
c) for both of above situation
d) for none of above situation

ix) Which of the following method is used for sorting in merge sort?
a) merging b) partitioning
c) selection d) exchanging

x) Key value pairs is usually seen in.....
a) Hash tables b) Heaps
c) Both Hash tables and Heaps d) Skip list

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. Explain the concept of priority queue with an example.
3. Illustrate the sequential search with suitable example.
4. Write a non recursive depth-first traversal algorithm.
5. Write and explain the algorithm for Tower of Hanoi.
6. What is hashing? Explain the terms hash collision.
7. Explain why the straight selection sort is more efficient than the bubble sort.
8. Explain different types of binary tree with suitable example

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. Describe using an example, how an arithmetic expression can be represented using a binary tree. Once represented, how can the expression be output in postfix notation?
10. Define stack as an ADT. Explain the condition that is to be checked for Push and Pop operations when stack is implemented using array?
11. Explain the advantages and disadvantages of representing a group of items as an array versus a linear linked list with suitable examples.

MODEL SET 7

Section A

Attempt all the questions. **(10 × 1 = 10)**

1. Circle (O) the correct answer.

i) An ADT is defined to be a mathematical model of a user-defined type along with the collection of all _____ operations on that model.
   a) Cardinality b) Assignment
   c) Primitive d) Structured

ii) Consider that n elements are to be sorted. What is the worst case time complexity of Bubble sort?
   a) O(1) b) O(log2n)
   c) O(n) d) O(n2)

iii) The memory address of the first element of an array is called.....
   a) Floor address b) Foundation address
   c) First address d) Base address

iv) In Breadth First Search of Graph, which of the following data structure is used?
   a) Stack b) Queue
   c) Linked List d) None of the above

v) Which of the following operations is performed more efficiently by doubly linked list than by singly linked list?
   a) Deleting a node whose location in given
   b) Searching of an unsorted list for a given item
   c) Inverting a node after the node with given location
   d) Traversing a list to process each node

vi) The best average behavior is shown by.....
   a) Quick Sort b) Merge Sort
   c) Insertion Sort d) Heap Sort

vii) Which of the following is not the required condition for binary search algorithm?
   a) The list must be sorted
   b) There should be the direct access to the middle element in any sub-list
   c) There must be mechanism to delete and/or insert elements in list
   d) None of above

viii) Which data structure is needed to convert infix notation to postfix notation?
   a) Branch b) Queue
   c) Tree d) Stack

ix) Which of the following is not a limitation of binary search algorithm?
   a) Must use a sorted array
   b) Requirement of sorted array is expensive when a lot of insertion and deletions are needed
   c) There must be a mechanism to access middle element directly
   d) Binary search algorithm is not efficient when the data elements are more than 1000

x) The largest element of an array index is called its
   a) lower bound b) range
   c) upper bound d) All of these

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. What do you mean by hash collision? Insert following data item into hash table of size 15 by using any one of the hash collision method.
   {44, 15, 30, 45, 55, 78, 90, 115, 35, 10, 33}
4. What is heap sort? Sort following data items by using heap sort:
   A[ ]={3,5,6,77,32,54,1,4}
5. Write complete recursive C program for TOH problem used in recursion.
6. What is the concept behind priority queue? Write C methods for inserting and deleting elements form priority queue.
7. Sort following data items by using quick sort:
   A[ ]={33,25,16,87,32,54,12,4}
8. Create binary search tree for following list of elements: {95, 73, 19, 98, 11, 17, 2, 70, 44, 169, 89, 409} and display the In-order, pre-order and post-order traversal of that tree.
9. What are the advantages of circular list over singly linked list? How to delete specific node from singly linked list? Explain.

Group C

Attempt any TWO questions. **[2x10 = 20]**

10. Construct expression tree of given expression A $ B + C / D * E. Convert following infix expression to their equivalent postfix expression by using stack.
    A $ B + C / D * E+(F+G-H/I/J)
11. What do you mean by spanning tree and minimum spanning tree? Describe Prim's algorithm for finding MST of given graph with suitable example.
12. What do you mean by divide and conquer algorithm? Write down algorithm for quick sort and trace the algorithm for following data items:
    A[ ]= { 8, 3, 4, 77, 23, 5, 7, 3, 9, 1, 19}

MODEL SET 8

Section A

Attempt all the questions. **(10 × 1 = 10)**

1. Circle (O) the correct answer.

i) Which of the following data structures are indexed structures?
   a) linear arrays b) linked lists
   c) both of above d) none of above

ii) A queue stores items in order of
   a) FIFO (First In First Out) list b) LIFO (Last In First Out) list
   c) Ordered array d) Linear tree

iii) What is the result of the following operation Top (Push (S, X))
   a) X b) null
   c) S d) None of these

iv) What is the postfix form of the following prefix *+ab–cd

a) ab+cd–* b) abc+*–
c) ab+*cd– d) ab+*cd–

v) In a circularly linked list organization, insertion of a record involves the modification of.....

a) no pointer b) 1 pointer
c) 2 pointers d) 3 pointers

vi) Which of the following traversal techniques lists the nodes of a binary search tree in ascending order?

a) Post-order b) In-order
c) Pre-order d) None of the above

vii) Merge sort uses.....

a) Divide and conquer strategy b) Backtracking approach
c) Heuristic search d) Greedy approach

viii) Which of the following is useful in implementing quick sort?

a) Stack b) Set
c) List d) Queue

ix) Which of the following sorting algorithm has the worst time complexity of nlogn?

a) Heap sort b) Quick sort
c) Insertion sort d) Selection sort

x) The postfix equivalent of the prefix * + a b – c d is.....

a) ab + cd -* b) abcd + -*
c) ab + cd* – d) ab + – cd*

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. What is data-structure? Describe stack and queue data structure with suitable example.
3. What are some examples of dynamic programming algorithms? How dynamic programmings differ from greedy algorithms? Explain
4. What is stack? Why do we use stacks? What operations can be performed on stacks?
5. What is a recursive function? write down program for simulating Fibonacci series.
6. How can a singly linked list be implemented so that insertion requires no test for whether head is null?
7. Draw the expression tree for a*(b + c)*(d*e + f).
8. What are the main operations of priority queue? Explain.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. Trace the algorithm to convert given infix to postfix expressions:
   a. (A + B) * C + D / (E + F * G) – H
   b. ((H * ((((A + ((B + C) * D)) * F) * G) * E)) + J)
10. How would you remove a node from a doubly linked list? Explain with suitable example and algorithm.
11. Write a complete menu driven program for performing various operation in array implementation of circular queue.

❑❑❑

Object Oriented Programming in Java

Year /Semester: II/III

Course Code: CACS 204
Course Title: Object Oriented Programming in Java

Course Description

This course covers preliminary concepts of object-oriented approach in programming with the basic skills using java. Control structures, classes, methods and argument passing and iteration; graphical user interface basics programming and documentation style.

Course Objectives

The general objectives of this course are to provide fundamental concepts of object oriented programming and make students familiar with java environment and its applications.

Course Contents

Unit 1: Introduction to Java **2 hrs.**

Definition, History of Java, the internet and java's place in IT, Applications and Applets, Java Virtual machine, Byte Code- not an Executable code, Procedure Oriented vs. Object-oriented programming, compiling and running a simple program, setting up your computer for java environment. Writing a program, compiling, interpreting and running the program, handling common errors

Unit 2: Tokens, Expressions and control structures **5 Hrs.**

Primitive data types: Integers, floating-points, characters, Booleans; user defined data types, declarations, constants, identifiers, Literals, Type conversion and casting, variables: variable definition and assignment, default variable initializations; command-line arguments, arrays of primitive data types, comment syntax, Garbage collection, expressions, using Operators: Arithmetic; Bitwise, relational, logical, Assignment, conditional, Shift, Ternary, Auto-increment and auto decrement; using control statements (Branching: if, switch, looping: while, do-while, for; jumping statements; break, continue and return)

Unit 3: Object Oriented Programming Concepts **9 Hrs.**

Fundamentals of classes: A simple class, creating class instances, adding methods to a class, calling functions/methods; Abstraction, encapsulation, Using 'this' keyword, constructors, default constructors, Parameterized constructors, More on methods: Passing by value, passing by reference, access control, Methods that return values, Polymorphism and method overloading, Recursion; Nested and inner classes.

Unit 4: Inheritance and Packaging **3 Hrs.**

Inheritance: using 'extends' keyword, subclasses and super classes, 'super' keyword usage, overriding methods, Dynamic method dispatch; The object class, abstract and final classes, packages: Defining a package, importing a Package: Access control; Interfaces: Defining an interface, implementing and applying interfaces.

Unit 5: Handling Error/Exceptions **2 Hrs.**

Basic Exceptions, Proper use of exceptions, User defined Exceptions, Catching Exceptions: try, catch; Throwing and re-throwing: throw, throws; Cleaning up using the finally clause.

Unit 6: Handling Strings **2 Hrs.**

Creation, concatenation and conversion of a string, changing case, character extraction, String comparison, Searching strings, Modifying Strings, String Buffer

Unit 7: Threads **3Hrs.**

Create/Instantiate/Start New Threads: Extending java.lang. Thread, implementing java.lang. Runnable Interface; Understand Thread Execution, thread priorities, Synchronization, Inter-Thread Communication, Deadlock

Unit 8: I/O and Streams **2Hrs.**

Java.io package, File and directories, Streams: Byte streams and character streams; reading/writing console Input/output, Reading and writing files, the serialization interface, serialization and de-serialization.

Unit 9: Understanding Core Packages **3 Hrs.**

Using java.lang Package: java.lang.Math, Wrapper classes and associated methods (Number, Double, Float, Integer, Byte, short long, character, Boolean); Using java.util package: Core classes (Vector, Stack, Dictionary, Hash table, Enumerations, Random Number Generator)

Unit 10: Holding Collection of Data **3 Hrs.**

Array and collection classes/interfaces, Map/List/Set Implementations: Map Interface, "List Interface, set Interface, Collection classes: Array List, Linked list, Hash set and Tree Set; Accessing Collection/Use of an Iterator, comparator.

Unit 11: Java Applications **8 Hrs.**

About AWT and Swing, About JFrame (a top level window in Swing). Swing components (JLabel, about text component like JTextField, JButton, Event Handling in swing applications. Layout Management using Flow Layout, Border Layout, Grid Layout, Using JPanel, Choice components like JCheck Box, JRadio Button, Borders components, JCombo Box and its events, JList and its events with MVC patterns, Key and Mouse Events Handling, Menu in swing, JText Area, Dialog boxes in swing, JTable for Displaying Data in Tabular form, MDI using JDesktop Pane and JInternal Frame, Using IDE like NEtbeans, JBuilder for building java applications using Drag and Drop), Adapter classes

Unit 12: Introduction to Java Applets **1 Hrs.**

Definition, Applet life cycle methods, Build a simple applet, Using Applet viewer, Adding controls: Animation concepts.

Unit 13: Database Programming using JDBC **2 Hrs.**

Using Connection, statement and result set interfaces for manipulating data with the database.

Laboratory Works

Laboratory works should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course. Project should be assigned on individual Basis.

TRIBHUVAN UNIVERSITY

Faculty of Humanities & Social Sciences

OFFICE OF THE DEAN

TU QUESTIONS-ANSWERS 2019

Bachelor in Computer Applications | **Full Marks:** 60
Course Title: OOPS in Java | **Pass Marks:** 24
Course Code: CACS 204 | **Time:** 3 hr.
Semester: III

Candidates are required to answer the questions in their own words as far as possible.

Section A

Attempt all the questions. **(10 × 1 = 10)**

1. Circle (O) the correct answer.

i) Which one of the following is not a valid java bitwise operator?
a) >> b) <<
c) >>> d) <<<

ii) Which one of the following keyword is used to declare an exception?
a) throws b) throw
c) try d) catch

iii) Which of these is an incorrect array declaration?
a) int ary[] = new int[5]; b) int[] ary = new int[5];
c) int ary = int[5] new; d) int ary[]; ary = new int[5];

iv) Which one of the following access specifier is appropriate for members of superclass to access only from subclass?
a) private b) protected
c) public d) default

v) Which one of the following is not a collection class defined in java?
a) Linked List b) Hash Set
c) Tree Set d) Graph Set

vi) Which one of the following inheritance is best implanted using interface in java?
a) single inheritance b) multi-level inheritance
c) multiple inheritance d) hierarchical inheritance

vii) Which one of the following method is called only once during the run time of your applet?
a) stop() b) paint()
c) init() d) start()

viii) Which of these methods of class String is used to compare two String objects for their equality?
a) equals() b) Equals()
c) is Equal() d) Is Equal()

ix) What is the default value of priority variable MIN_PRIORITY and MAX_PRIORITY?
a) 0 & 63 b) 1 & 10
c) 0 & 1 d) 1 & 32

x) Which one of the following is not java swing container?
a) Panel b) Tabbed Pane
c) Scroll Pane d) Scroll bar

Answer-Key

i. (d)	ii. (c)	iii. (b)	iv. (b)	v. (d)	vi. (c)	vii. (c)	viii. (a)	ix. (b)	x. (c)

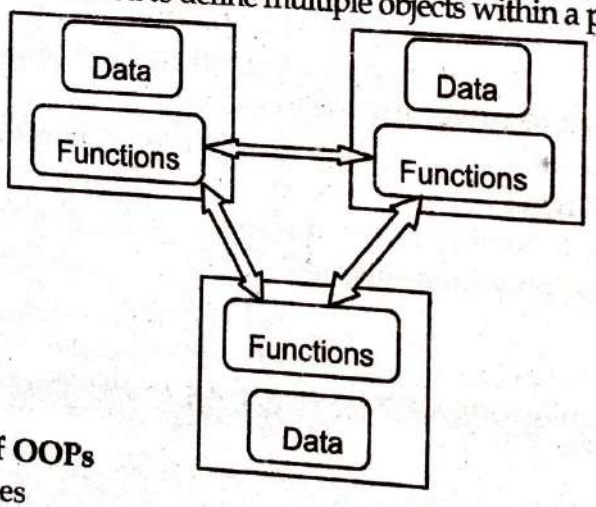
Group B

Attempt any SIX questions. **[6x5 = 30]**

2. Define OOP. Explain features of Object Oriented Programming Language. [1 + 4]

Ans: Object oriented programming can be defined as a programming model which is based upon the concept of objects. Objects contain data in the form of attributes and code in the form of methods. OOP is a high-level programming language where a program is divided into small chunks called objects using the object-oriented model, hence the name. This paradigm is based on objects and classes.

- **Object** – An object is basically a self-contained entity that accumulates both data and procedures to manipulate the data. Objects are merely instances of classes.
- **Class** – A class, in simple terms, is a blueprint of an object which defines all the common properties of one or more objects that are associated with it. A class can be used to define multiple objects within a program.



Features of OOPs

- Classes
- Data Abstraction
- Inheritance
- Objects
- Encapsulation
- Polymorphism

What is Class?

Class represents a real world entity which acts as a blueprint for all the objects. We can create as many objects as we need using Class.

Example:

We create a class for "Student" entity as below

```
Student.java
Class Student
{
String id;
int age;
String course;
void enroll()
{
```

```
System.out.println("Student enrolled");
}
}
```

What is an Object?

Object Oriented Programming system (OOPS) is designed based on the concept of "Object". It contains both variables (used for holding the data) and methods (used for defining the behaviors). We can create any number of objects using this class and all those objects will get the same fields and behavior.

```
Student s1 = new Student();
```

Now we have created 3 objects s1, s2 and s3 for the same class "Student ". We can create as many objects as required in the same way. We can set the value for each field of an object as below,

```
s1.id=123;
s2.age=18;
s3.course="computers";
```

What is Abstraction?

Abstraction is a process where you show only relevant data and hide unnecessary details of an object from the user. For example, when you login to your bank account online, you enter your user_id and password and press login, what happens when you press login, how the input data sent to server, how it gets verified is all abstracted away from the you. We can achieve "abstraction" in Java using 2 ways

1. Abstract class
2. Interface

1. Abstract Class

Abstract class in Java can be created using "abstract " keyword. If we make any class as abstract then it can't be instantiated which means we are not able to create the object of abstract class. Inside Abstract class, we can declare abstract methods as well as concrete methods. So using abstract class, we can achieve 0 to 100 % abstraction.

Example:

```
Abstract class Phone
{
void receiveCall();
Abstract void sendMessage();
}
```

Anyone who needs to access this functionality has to call the method using the Phone object pointing to its subclass.

What is Encapsulation?

Encapsulation is the process of binding object state(fields) and behaviors(methods) together in a single entity called "Class". Since it wraps both fields and methods in a class, it will be secured from the outside access. We can restrict the access to the members of a class using access modifiers such as private, protected and public keywords. When we create a class in Java, it means we are doing encapsulation. Encapsulation helps us to achieve the re-usability of code without compromising the security.

What is Inheritance?

Inheritance provides the idea of reusability of code and each sub class defines only those features that are unique to it, rest of the features can be inherited from the parent class. Inheritance is a process of defining a new class based on an existing class by extending its common data members and methods. It allows us to reuse of code, it improves reusability in your java application. The parent class is called the base class or super class. The child class that extends the base class is called the derived class or sub class or child class. To inherit a class we use extends keyword. Here class A is child class and class B is parent class.

```
class A extends B
{
}
```

What is Polymorphism?

It is the concept where an object behaves differently in different situations. Since the object takes multiple forms, it is called Polymorphism. In java, we can achieve it using method overloading and method overriding. There are 2 types of Polymorphism available in Java,

- Method overloading
- Method overriding

3. Explain different types of control statements used in java. **[5]**

Ans: A control statement works as a determiner for deciding the next task of the other statements whether to execute or not. An 'If' statement decides whether to execute a statement or which statement has to execute first between the two. In Java, the control statements are divided into three categories which are selection statements, iteration statements, and jump statements. A program can execute from top to bottom but if we use a control statement.

1. **Decision Making in Java**
   - Simple if Statement
   - if…else Statement
   - Nested if statement
   - if...else if…else statement
   - Switch statement
2. **Looping Statements in Java**
   - While
   - Do…while
   - For
   - For-Each Loop
3. **Branching Statements in Java**
   - Break
   - Continue
   - Return

Decision Making in Java

Decision making statements are statements which decides what to execute and when. They are similar to decision making in real time. Control flow statements control the flow of a program's execution. Here flow of execution will be based on state of a program. We have 4 decision making statements available in Java.

Simple if Statement

Simple if statement is the basic of decision-making statements in Java. It decides if certain amount of code should be executed based on the condition. If statement executes an action if and only if the condition is true

Syntax:

```
if (condition)
{
Statemen 1; //if condition becomes true then this will be executed
}
Statement 2; //this will be executed irrespective of condition becomes true
or false
```

if...else Statement

In if...else statement, if condition is true then statements in if block will be executed but if it comes out as false then else block will be executed.

Syntax:

```
if (condition)
{
Statemen 1; //if condition becomes true then this will be executed
}
else
{
Statement 2:
}
```

Nested if statement

Nested if statement is if inside an if block. It is same as normal if...else statement but they are written inside another if...else statement.

Syntax:

```
if (condition1)
{
Statemen 1; //executed when condition1 is true
if (condition2)
{
Statement 2; //executed when condition2 is true
}
else {
Statement 3; //executed when condition2 is false
}
}
```

if...else if...else statement

if...else if statements will be used when we need to compare the value with more than 2 conditions. They are executed from top to bottom approach. As soon as the code finds the matching condition, that block will be executed. But if no condition is matching then the last else statement will be executed.

Syntax:

```
if (condition2)
{
Statemen 1; //if condition1 becomes true then this will be executed
}
else if (condition2)
{
Statement 2; // if condition2 becomes true then this will be executed
}
```

```
else
{
Statement 3; //executed when no matching condition found
}
```

Switch statement

Java switch statement compares the value and executes one of the case blocks based on the condition. It is same as if...else if ladder. Below are some points to consider while working with switch statements:

- Case value must be of the same type as expression used in switch statement
- Case value must be a constant or literal. It doesn't allow variables
- Case values should be unique. If it is duplicate, then program will give compile time error

Syntax

```
switch(expression)
{
case value1:
//code to be executed;
break; //optional
case value2:
//code to be executed;
break; //optional
.....
default:
Code to be executed if all cases are not matched;
}
```

Looping Statements in Java

Looping statements are the statements which execute a block of code repeatedly until some condition meet to the criteria. Loops can be considered as repeating if statements. There are 3 types of loops available in Java.

While loop

While loops are simplest kind of loop. It checks and evaluates the condition and if it is true then executes the body of loop. This is repeated until the condition becomes false. Condition in while loop must be given as a Boolean expression. If int or string is used instead, compile will give the error.

Syntax:

```
while (condition)
{
statement1;
}
```

Do...while loop

Do...while works same as while loop. It has only one difference that in do...while, condition is checked after the execution of the loop body. That is why this loop is considered as exit control loop. In do...while loop, body of loop will be executed at least once before checking the condition

Syntax:

```
Do
{
statement1;
}while(condition);
```

For Loop

It is the most common and widely used loop in Java. It is the easiest way to construct a loop structure in code as initialization of a variable, a condition and increment/decrement are declared only in a single line of code. It is easy to debug structure in Java.

Syntax:

```
for (initialization; condition; increment/decrement)
{
statement;
}
```

For-Each Loop

For-Each loop is used to traverse through elements in an array. It is easier to use because we don't have to increment the value. It returns the elements from the array or collection one by one.

Syntax:

```
for(Type var: array)
{
//code to be executed
}
```

4. Define Abstract Class. Explain different types of Access controls available in java. [5]

Ans: A class which is declared with the abstract keyword is known as an abstract class in Java. It can have abstract and non-abstract methods (method with the body).

If we declare a class as abstract, then it is necessary for you to subclass it so as to instantiate the object of that class i.e. we cannot instantiate object of abstract class without creating its subclass. The keyword **abstract** is used to create a class as an abstract class and it can contain abstract methods. Likewise, if you need your method to be always overridden before it can be used, you can declare the method as an abstract method using abstract keyword and without the method definition i.e. end it with semicolon. Remember, if you declare some method as an abstract method, you must declare your class as abstract. See the example skeleton below:

```
public abstract class A
{
.........
.........
public abstract void mymethod1(); //no definition
void myMethod2()
{
.....definition here
}
}
```

Here we cannot instantiate object of A, if we need to instantiate we must inherit class A to some other class such that it overrides the abstract methods in class A. If the derived class does not define all the abstract methods of the super class then the derived class again should be abstract.

Different types of Access controls available in java

Java Access Specifiers (also known as Visibility Specifiers) regulate access to classes, fields and methods in Java. These Specifiers determine whether a

field or method in a class, can be used or invoked by another method in another class or sub-class. Access Specifiers can be used to restrict access. Access Specifiers are an integral part of object-oriented programming.

Types of access specifiers:

In java we have four access specifiers and they are listed below.

- public
- private
- protected
- default(no specifiers)

Public specifiers

Public Specifiers achieves the highest level of accessibility. Classes, methods, and fields declared as public can be accessed from any class in the Java program, whether these classes are in the same package or in another package.

Private specifiers

Private Specifiers achieves the lowest level of accessibility. Private methods and fields can only be accessed within the same class to which the methods and fields belong. Private methods and fields are not visible within subclasses and are not inherited by subclasses. So, the private access specifier is opposite to the public access specifier. Using private specifier we can achieve encapsulation and hide data from the outside world.

Protected specifiers

Methods and fields declared as protected can only be accessed by the subclasses in other package or any class within the package of the protected members' class. The protected access specifier cannot be applied to class and interfaces.

Default (no specifier)

When we don't set access specifier for the element, it will follow the default accessibility level. There is no default specifier keyword. Classes, variables, and methods can be default accessed. Using default specifier we can access class, method, or field which belongs to same package, but not from outside this package.

Access Modifiers	Default	Private	Protected	Public
Accessible inside the class	Yes	Yes	Yes	Yes
Accessible within the subclass inside the same package	Yes	No	Yes	Yes
Accessible outside the package	No	No	No	Yes
Accessible within the subclass outside the package	No	No	Yes	Yes

5. Define method overriding? Write any program to implement concept of multiple inheritance in Java. [1 + 4]

Ans: The process of redefining the inherited method of the super class in the derived class is called method overriding. In a class hierarchy, when method in a subclass having the same name and type signature as method in its superclass, then the method present in subclass is said to override the method in superclass. When an overridden method is called from inside its subclass, it will always refer to the version of that method defined by the

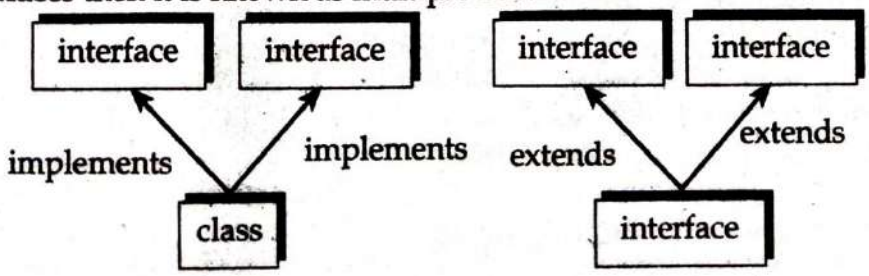
subclass. The version of the method is defined by the superclass will be hidden.

Example:

```
class A
 {
int i, j;
A(int x, int y)
 {
i = x;
j = y;
}
 void display()
 {
System.out.println("i and j : " + i + "  " + j);
}
 }
 class B extends A
 {
int k;
B(int x, int y, int z)
{
super(x, y);
k = z;
}
void display()
{
super.display();          // this calls A's display()
System.out.println("k : " + k);
}
 }
 class OverridDemo
 {
public static void main(String args[])
{
B subObj = new B(10, 20, 30);
subObj.display();    // this calls the display() in B
}
 }
```

Program to implement concept of multiple inheritance in Java

If a class implements multiple interfaces, or an interface extends multiple interfaces then it is known as multiple inheritance.



Multiple Inheritance in Java

Example: Multiple inheritance supported in java by using interface

```
interface A
{
void methodA();
}
interface B
{
void methodB();
}
class C implements A, B
{
public void methodA()
{
System.out.println("Within class C of method A");
}
public void methodB()
{
System.out.println("Within class C of method B");
}
public static void main(String args[])
{
C obj = new C();
obj.methodA();
obj.methodB();
}
}
```

Output:

Within class C of method A
Within class C of method B

6. **Why it is important to handle exception in java? Write a program to illustrate the use of exception handling.** **[1 + 4]**

Ans: An exception is a problem that arises during the execution of a program. When an Exception occurs the normal flow of the program is disrupted and the program/Application terminates abnormally, which is not recommended, therefore, these exceptions are to be handled. An exception can occur for many different reasons. Following are some scenarios where an exception occurs.

- A user has entered an invalid data.
- A file that needs to be opened cannot be found.
- A network connection has been lost in the middle of communications or the JVM has run out of memory.

Program to illustrate the use of exception handling

Let's see an example of Java Exception Handling where we using a try-catch statement to handle the exception.

```
public class JavaExceptionExample
{
public static void main(String args[])
{
try
```

```
{
//code that may raise exception
 int data=100/0;
}
catch(ArithmeticException e)
{
System.out.println(e);
}
//rest code of the program
System.out.println("rest of the code...");
}
}
```

7. Define the use of static keyword. Write any four String methods used in java with example. **[1 + 4]**

Ans: The static keyword in Java is used mainly for memory management. It is used with variables, methods, blocks and nested classes. It is a keyword that is used to share the same variable or method of a given class. This is used for a constant variable or a method that is the same for every instance of a class. The main method of a class is generally labeled static. The static can be:

- Variable
- Method
- Block
- Nested class

Any four String methods used in java

length()

This method is used to get the number of character of any string.

Example

```
class StringHandling
{
public static void main(String arg[])
{
int l;
String s=new String("Java");
l=s.length();
System.out.println("Length: "+l);
}
}
```

Output

Length: 4

charAt(index)

This method is used to get the character at a given index value.

Example

```
class StringHandling
{
public static void main(String arg[])
{
char c;
String s=new String("Java");
c=s.charAt(2);
```

```
System.out.println("Character: "+c);
}
}
```

Output

Character: v

toUpperCase()

This method is use to convert lower case string into upper case.

Example

```
class StringHandling
{
public static void main(String arg[])
{
String s="Java";
System.out.println("String: "+s.toUpperCase());
}
}
```

Output

String: JAVA

concat()

This method is used to combine two strings.

Example

```
class StringHandling
{
public static void main(String arg[])
{
String s1="Aarav";
String s2="Saud";
System.out.println("Combined String: "+s1.concat(s2));
}
}
```

Output

Combined String: AaravSaud

8. Define super, final and this keyword in java. Explain the concept of MVC in brief. **[5]**

Ans: Super keyword in java

Super keyword in java is a reference variable that is used to refer parent class object. Super is implicit keyword creating by JVM and supply each and every java program for performing important role in three places.

- Super keyword At Variable Level
- Super keyword At Method Level
- Super keyword At Constructor Level

Super can be used to refer immediate parent class instance variable, parent class method and to invoke immediate parent class constructor.

Whenever the derived class is inherits the base class features, there is a possibility that base class features are similar to derived class features and JVM gets an ambiguity. In order to differentiate between base class features and derived class features must be preceded by super keyword.

Example

```
class Employee
```

```
{
float salary=10000;
}
class HR extends Employee
{
float salary=20000;
void display()
{
System.out.println("Salary: "+super.salary);//print base class salary
}
}
class Supervarible
{
public static void main(String[] args)
{
HR obj=new HR();
obj.display();
}
}
```

Final keyword in java

It is used to make a variable as a constant, Restrict method overriding, Restrict inheritance. It is used at variable level, method level and class level. In java language final keyword can be used in following way.

- Final Keyword at Variable Level
- Final Keyword at Method Level
- Final Keyword at Class Level

Final at variable level

Final keyword is used to make a variable as a constant. This is similar to const in other language. A variable declared with the final keyword cannot be modified by the program after initialization. This is useful to universal constants, such as "PI".

Example

```
public class Circle
{
public  static final double PI=3.14159;
public static void main(String[] args)
{
System.out.println(PI);
}
}
```

This keyword in java

This is a reference variable that refers to the current object. It is a keyword in java language represents current class object

Usage of this keyword

- It can be used to refer current class instance variable.
- this() can be used to invoke current class constructor.
- It can be used to invoke current class method (implicitly)
- It can be passed as an argument in the method call.
- It can be passed as argument in the constructor call.

- It can also be used to return the current class instance.

The main purpose of using this keyword is to differentiate the formal parameter and data members of class, whenever the formal parameter and data members of the class are similar then JVM get ambiguity (no clarity between formal parameter and member of the class)

Example of this keyword in java

```
class Employee
{
int id;
String name;
Employee(int id, String name)
{
this.id = id;
this.name = name;
}
void show()
{
System.out.println(id+" "+name);
}
public static void main(String args[])
{
Employee e1 = new Employee(11,"Aarav");
Employee e2 = new Employee(12,"Anuj");
e1.show();
e2.show();
}
}
```

Concept of MVC

MVC Pattern stands for Model-View-Controller Pattern. This pattern is used to separate application's concerns.

- **Model** - Model represents an object or JAVA POJO carrying data. It can also have logic to update controller if its data changes.
- **View** - View represents the visualization of the data that model contains.
- **Controller** - Controller acts on both model and view. It controls the data flow into model object and updates the view whenever data changes. It keeps view and model separate.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. (a) Define multithreading. Write a java program to show the inter-thread communication. **[1 + 4]**

Ans: Multithreading in java is a process of executing multiple threads simultaneously. The aim of multithreading is to achieve the concurrent execution.

Interthread Communication

The process of execution of exchanging of the data / information between multiple threads is known as Interthread communication or if an output of first thread giving as an input to second thread the output of second thread giving as an input to third thread then the communication between first

second and third thread known as Interthread communication. In order to develop Interthread communication application we use some of the methods of java.lang.Object class and these methods are known as Interthread communication methods. Interthread communication methods:

- public final void wait(long msec)
- public final void wait()
- public final void notify()
- public final void notifyAll()

Java program to show the inter-thread communication

```
import java.util.Scanner;
public class threadexample
{
public static void main(String[] args) throws InterruptedException
{
  final PC pc = new PC();
  // Create a thread object that calls pc.produce()
  Thread t1 = new Thread(new Runnable()
  {
   public void run()
   {
  try
  {
  pc.produce();
   }
   {
  e.printStackTrace();
 }
 }
 });
 // Create another thread object that calls
 Thread t2 = new Thread(new Runnable()
 {
   public void run()
   {
     try
     {
       pc.consume();
     }
     catch(InterruptedException e)
     {
       e.printStackTrace();
     }
   }
 });
 t1.start();
 t2.start();
 t1.join();
 t2.join();
}
```

```
public static class PC
{
    public void produce() throws InterruptedException
    {
        synchronized(this)
        {
            System.out.println("producer thread running");
            wait();
            System.out.println("Resumed");
        }
    }
    public void consume()throws InterruptedException
    {
        Thread.sleep(1000);
        Scanner s = new Scanner(System.in);
        synchronized(this)
        {
            System.out.println("Waiting for return key.");
            s.nextLine();
            System.out.println("Return key pressed");
            notify();
            Thread.sleep(2000);
        }
    }
}
}
```

Output:
producer thread running
Waiting for return key.
Return key pressed
Resumed

(b) Define Stream. Write a program in java to copy the content from one file to another. **[1 + 4]**

Ans: A stream is a sequence of objects that supports various methods which can be pipelined to produce the desired result. The features of Java stream are - A stream is not a data structure instead it takes input from the Collections, Arrays or I/O channels. The features of Java stream are:

- A stream is not a data structure instead it takes input from the Collections, Arrays or I/O channels.
- Streams don't change the original data structure; they only provide the result as per the pipelined methods.
- Each intermediate operation is lazily executed and returns a stream as a result, hence various intermediate operations can be pipelined. Terminal operations mark the end of the stream and return the result.

Program in java to copy the content from one file to another

FileReader and FileWriter can be combined together to copy a content from one file to another.

```
import java.io.BufferedReader;
import java.io.FileReader;
```

```
import java.io.FileWriter;
import java.io.IOException;
public class FileCopyExample
{
public static void main(String[] args)
{
try {
FileReader fr = new FileReader("input.txt");
BufferedReader br = new BufferedReader(fr);
FileWriter fw = new FileWriter("output.txt", true);
String s;
while ((s = br.readLine()) != null)
{
fw.write(s); // write to output file
fw.flush();
}
br.close();
fw.close();
System.out.println("file copied");
} catch (IOException e)
{
e.printStackTrace();
}
  }
}
```

10. (a) Define Collection Class. Explain different Wrapper classes and associated methods in java. [1 + 4]

Ans: Collections class in java is a useful utility class to work with collections in java. The java.util.Collections class directly extends the Object class and exclusively consists of the static methods that operate on Collections or return them.

Wrapper classes in java

For each and every fundamental data type there exist a pre-defined class, such predefined class is known as wrapper class. The purpose of wrapper class is to convert numeric string data into numerical or fundamental data. We know that in java whenever we get input from user, it is in the form of string value so here we need to convert these string values in different data type (numerical or fundamental data), for this conversion we use wrapper classes.

The following table gives fundamental data type corresponding wrapper class name and conversion method from numerical String into numerical values or fundamental value.

Fundamental DataType	Wrapper CalssName	Conversion method from numeric string into fundamental or numeric value
Byte	Byte	public static byte parseByte(String)
short	Short	public static short parseShort(String)
Int	Integer	public static integer parseInt(String)
Long	Long	public static long parseLong(String)
float	Float	public static float parseFloat(String)

double	Double	public static double parseDouble(String)
char	Character	
boolean	Boolean	public static boolean parseBoolean(String)

All the wrapper class methods are static in nature so we need to call these method using class.methodName().

- for Integer: int x=Integer.parseInt(String);
- for float: float x=Float.parseFloat(String);
- for double: double x=Double.parseDouble(String);

(b) Define AWT. Explain different types of Layout Managers in java. **[1+ 4]**

Ans: The Abstract Window Toolkit (AWT) is Java's original platform-dependent windowing, graphics, and user-interface widget toolkit, preceding Swing. The AWT is part of the Java Foundation Classes (JFC): the standard API for providing a graphical user interface (GUI) for a Java program. Java AWT components are platform-dependent i.e. components are displayed according to the view of operating system. AWT is heavyweight i.e. its components are using the resources of OS. The java.awt package provides classes for AWT API such as TextField, Label, TextArea, RadioButton, CheckBox, Choice, List etc.

Different types of Layout Managers in java

Following is the list of commonly used controls while designed GUI using AWT.

S.N.	LayoutManager & Description
1	**BorderLayout** The borderlayout arranges the components to fit in the five regions: east, west, north, south and center.
2	**CardLayout** The CardLayout object treats each component in the container as a card. Only one card is visible at a time.
3	**FlowLayout** The FlowLayout is the default layout.It layouts the components in a directional flow.
4	**GridLayout** The GridLayout manages the components in form of a rectangular grid.
5	**GridBagLayout** This is the most flexible layout manager class. The object of GridBagLayout aligns the component vertically, horizontally or along their baseline without requiring the components of same size.

11. (a) List and explain any five swing controls with their uses. **[5]**

Ans: Every user interface considers the following three main aspects:

- **UI Elements** – these are the core visual elements the user eventually sees and interacts with. GWT provides a huge list of widely used and common elements varying from basic to complex.
- **Layouts** – they define how UI elements should be organized on the screen and provide a final look and feel to the GUI (Graphical User Interface).
- **Behavior** – these are the events which occur when the user interacts with UI elements.

Every SWING controls inherits properties from the following Component class hierarchy.

S.N.	Class & Description
1	**Component** A Component is the abstract base class for the non menu user-interface controls of SWING. Component represents an object with graphical representation
2	**Container** A Container is a component that can contain other SWING components
3	**JComponent** A JComponent is a base class for all SWING UI components. In order to use a SWING component that inherits from JComponent, the component must be in a containment hierarchy whose root is a top-level SWING container

SWING UI Elements

Following is the list of commonly used controls while designing GUI using SWING.

S.N.	Class & Description
1	**JLabel** A JLabel object is a component for placing text in a container.
2	**JButton** This class creates a labeled button.
3	**JColorChooser** A JColorChooser provides a pane of controls designed to allow a user to manipulate and select a color.
4	**JCheck Box** A JCheckBox is a graphical component that can be in either an on (true) or off (false) state.
5	**JRadioButton** The JRadioButton class is a graphical component that can be in either an on (true) or off (false) state. in a group.
6	**JList** A JList component presents the user with a scrolling list of text items.
7	**JComboBox** A JComboBox component presents the user with a to show up menu of choices.
8	**JTextField** A JTextField object is a text component that allows for the editing of a single line of text.
9	**JPasswordField** A JPasswordField object is a text component specialized for password entry.
10	**JTextArea** A JTextArea object is a text component that allows editing of a multiple lines of text.
11	**ImageIcon** A ImageIcon control is an implementation of the Icon interface that paints Icons from Images
12	**JScrollbar** A Scrollbar control represents a scroll bar component in order to enable the user to select from range of values.
13	**JOptionPane** JOptionPane provides set of standard dialog boxes that prompt users for a

	value or informs them of something.
14	**JFileChooser** A JFileChooser control represents a dialog window from which the user can select a file.
15	**JProgressBar** As the task progresses towards completion, the progress bar displays the task's percentage of completion.
16	**JSlider** A JSlider lets the user graphically select a value by sliding a knob within a bounded interval.
17	**JSpinner** A JSpinner is a single line input field that lets the user select a number or an object value from an ordered sequence.

b) Define JDBC. Write a program to display all records from a table of database. [5]

Ans: Java Database Connectivity (JDBC) is an application programming interface (API) for the programming language Java, which defines how a client may access any kind of tabular data, especially relational database. It is part of Java Standard Edition platform, from Oracle Corporation. It acts as a middle layer interface between java applications and database. The JDBC classes are contained in the Java Package java.sql and javax.sql.

JDBC helps you to write Java applications that manage these three programming activities:

- Connect to a data source, like a database.
- Send queries and update statements to the database
- Retrieve and process the results received from the database in answer to your query

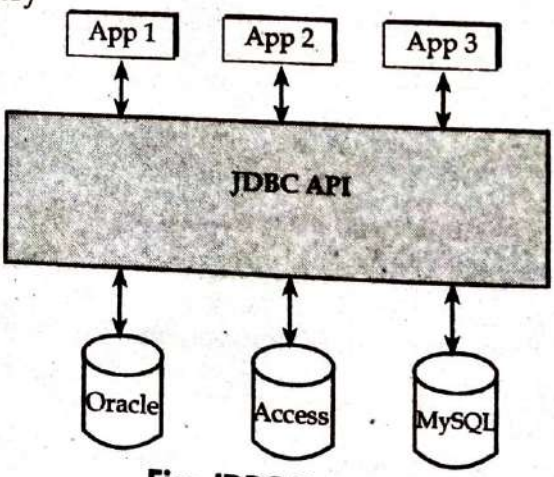


Fig: JDBC Drivers

JDBC drivers are client-side adapters (installed on the client machine, not on the server) that convert requests from Java programs to a protocol that the DBMS can understand. There are 4 types of JDBC drivers:

- Type-1 driver or JDBC-ODBC bridge driver
- Type-2 driver or Native-API driver
- Type-3 driver or Network Protocol driver
- Type-4 driver or Thin driver

Program part

```
import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.ResultSet;
```

```
import java.sql.Statement;
public class DisplayAll
{
public static void main(String[] args)
{
try{
Class.forName("com.mysql.jdbc.Driver").newInstance();
//serverhost = localhost, port=3306, username=root, password=123
Connection        cn=DriverManager.getConnection("jdbc:mysql://localhost:
3306/demo","root","123");
Statement smt=cn.createStatement();
//query to display all records from table employee
String q="Select * from employees";
//to execute query
ResultSet rs=smt.executeQuery(q);
//to print the resultset on console
if(rs.next())
{
do{
System.out.println(rs.getString(1)+","+rs.getString(2)+","+rs.getString(3)+","+
rs.getString(4)+","+rs.getString(5));
}while(rs.next());
}
else{
System.out.println("Record Not Found...");
    }
    cn.close();
}
catch(Exception e)
{
System.out.println(e);
}
}
}
```

Output (In console)

100, Aarav, 10/10/1990, Kathmandu, 55000

TRIBHUVAN UNIVERSITY

Faculty of Humanities & Social Sciences

OFFICE OF THE DEAN

TU QUESTIONS-ANSWERS 2020

Bachelor in Computer Applications — **Full Marks:** 60
Course Title: OOPS in Java — **Pass Marks:** 24
Course Code: CACS 204 — **Time:** 3 hr.
Semester: III

Candidates are required to answer the questions in their own words as far as possible.

Section A

Attempt all the questions. **(10 × 1 = 10)**

1. **Circle (O) the correct answer.**

i. Which of the following is a java compilter?

a) java.exe **b) . javac.class**
c) java.exe d) . java.class

ii. What is the size of char type in Java?

a) 1 byte **b) . 2 bytes**
c) 4 bytes d) . 4 bits

iii. Which of the following is not a keyword in Java?

a) main b) . class
c) new d) . super

iv. If a=10 and b=6, then what will be the value of a^b in java?

a) 4 b) . 3
c) 14 **d) . 12**

v. Which of the following inheritance is not directly available in java?

a) single inheritance b) .multi-level inheritance
c) multiple inheritance d) . hybrid inheritance

vi. Which of the following method is direclty accessed without creating object?

a) Public method **b) .static method**
c) final method d) .abstract method

vii. Which of the following keyword is used to throw an exception manually?

a) throw b) . try
c) catch d) . finally

viii. Which of the following is not a byte stream input class?

a) FileInputStream b) . ObjectInputStream
c) BufferReader **d) . SequenceInputStream**

ix. Which of the following package is imputed by default in java?

a) java.util **b) . java.lang**

c) java.io d) . java.awt

x. Which of the following is not a mouse event in java?

a) mouseClick() b) . mousePressed()

c) **mouseScrolled()** d) . mouseExited()

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. Define OOP. Write the characteristics of OOP language. [1+4]

Ans: Object oriented programming can be defined as a programming model which is based upon the concept of objects. Objects contain data in the form of attributes and code in the form of methods. OOP is a high-level programming language where a program is divided into small chunks called objects using the object-oriented model, hence the name. This paradigm is based on objects and classes.

- **Object**: An object is basically a self-contained entity that accumulates both data and procedures to manipulate the data. Objects are merely instances of classes.
- **Class**: A class, in simple terms, is a blueprint of an object which defines all the common properties of one or more objects that are associated with it. A class can be used to define multiple objects within a program.

The characteristics of OOP language are listed below

1. Class
2. Object
3. Method and method passing
4. Pillars of OOPs
   - Abstraction
   - Encapsulation
   - Inheritance
   - Polymorphism
     - Compile-time polymorphism
     - Runtime polymorphism

1. **Object:** Objects are the entities in an object oriented system through which we perceive the world around us. We naturally see our environment as being composed of things which have recognizable identities & behavior. The entities are then represented as objects in the program. They may represent a person, a place, a bank account, or any item that the program must handle. For example Automobiles are objects as they have size, weight, color etc. as attributes (that is data) and starting, pressing the brake, turning the wheel, pressing accelerator pedal etc. as operation (that is functions).
2. **Class:** A class is a user-defined blueprint or prototype from which objects are created. It represents the set of properties or methods that are common to all objects of one type. Using classes, you can create multiple objects with the same behavior instead of writing their code multiple times. This includes classes for objects occurring more than once in your code.
3. **Message Passing:** Message Passing: Objects communicate with one another by sending and receiving information to each other. A message for an object is a request for execution of a procedure and therefore will

invoke a function in the receiving object that generates the desired results. Message passing involves specifying the name of the object, the name of the function and the information to be sent.

Four Pillars of OOPs

The four principles of object oriented programming are listed below:

Pillar 1: Abstraction

Data Abstraction is the property by virtue of which only the essential details are displayed to the user. The trivial or non-essential units are not displayed to the user.

Example: A car is viewed as a car rather than its individual components.

Data Abstraction may also be defined as the process of identifying only the required characteristics of an object, ignoring the irrelevant details. The properties and behaviors of an object differentiate it from other objects of similar type and also help in classifying/grouping the object.

Consider a real-life example of a man driving a car. The man only knows that pressing the accelerators will increase the car speed or applying brakes will stop the car, but he does not know how on pressing the accelerator, the speed is actually increasing. He does not know about the inner mechanism of the car or the implementation of the accelerators, brakes etc. in the car.

In Java, abstraction is achieved by interfaces and abstract classes. We can achieve 100% abstraction using interfaces.

Pillar 2: Encapsulation

It is defined as the wrapping up of data under a single unit. It is the mechanism that binds together the code and the data it manipulates. Another way to think about encapsulation is that it is a protective shield that prevents the data from being accessed by the code outside this shield.

Technically, in encapsulation, the variables or the data in a class is hidden from any other class and can be accessed only through any member function of the class in which they are declared.

In encapsulation, the data in a class is hidden from other classes, which is similar to what data-hiding does. So, the terms "encapsulation" and "data-hiding" are used interchangeably.

Encapsulation can be achieved by declaring all the variables in a class as private and writing public methods in the class to set and get the values of the variables.

Pillar 3: Inheritance

Inheritance is an important pillar of OOP (Object Oriented Programming). It is the mechanism in Java by which one class is allowed to inherit the features (fields and methods) of another class.

- **Superclass:** The class whose features are inherited is known as superclass (also known as base or parent class).
- **Subclass:** The class that inherits the other class is known as subclass (also known as derived or extended or child class). The subclass can add its own fields and methods in addition to the superclass fields and methods.
- **Reusability:** Inheritance supports the concept of "reusability", i.e. when we want to create a new class and there is already a class that includes some of the code that we want, we can derive our new class

from the existing class. By doing this, we are reusing the fields and methods of the existing class.

Pillar 4: Polymorphism

Polymorphism means 'having many forms'. The polymorphism allows different objects to respond to the same operation in different ways, the response being specific to the type of object. The different ways of using same function or operator depending on what they are operating on is called polymorphism. It refers to the ability of object-oriented programming languages to differentiate between entities with the same name efficiently. This is done by Java with the help of the signature and declaration of these entities.

Example: A person at the same time can have different characteristics. Like a man at the same time is a father, a husband, an employee. So the same person possesses different behavior in different situations. This is called polymorphism.

3. **Explain the operators available in java programming. [5]**

Ans: An operator is a symbol that tells the computer to perform certain mathematical or logical manipulation. Operators are used in the program to manipulate data and variables. They usually form a part of the mathematical or logical expression. Java operators can be divided into following categories:

- Arithmetic Operators
- Relational Operators
- Bitwise Operators
- Logical Operators
- Assignment Operators
- conditional operator or Ternary operator
- Auto increment/Auto decrement operator
- Miscellaneous Operators

Arithmetic Operators

The basic arithmetic operations in Java Programming are addition, subtraction, multiplication, and division. Arithmetic Operations are operated on Numeric Data Types as expected. Arithmetic Operators can be overloaded. Arithmetic Operators are "Binary" Operators i.e. they operate on two operands. These operators are used in mathematical expressions in the same way that they are used in algebra.

Operator	Description	Example
+ (Addition)	Adds two operands	5 + 10 =15
- (Subtraction)	Subtract second operands from first. Also used to Concatenate two strings	10 - 5 =5
* (Multiplication)	Multiplies values on either side of the operator.	10 * 5 =50
/ (Division)	Divides left-hand operand by right-hand operand.	10 / 5 =2
% (Modulus)	Divides left-hand operand by right-hand operand and returns remainder.	5 % 2 =1
++ (Increment)	Increases the value of operand by 1.	2++ gives 3
-- (Decrement)	Decreases the value of operand by 1.	3-- gives 2

Example: The following program is a simple example which demonstrates the arithmetic operators.

```
class ArithmeticOperations
{
        public static void main (String[] args)
        {
                int answer = 2 + 2;
                System.out.println(answer);
                answer = answer - 1;
                System.out.println(answer);
                answer = answer * 2;
                System.out.println(answer);
                answer = answer / 2;
                System.out.println(answer);
                answer = answer + 8;
                System.out.println(answer);
                answer = answer % 7;
                System.out.println(answer);
        }
}
```

Output

4
3
6
3
11
4

Relational Operators

Relational Operators are binary operators used to checking relation between two variables or numbers. Relational Operators returns "Boolean" value i.e. it will return true or false. Most of the relational operators are used in "If statement" and inside Looping statement in order to check truthiness or falseness of condition.

Operators	Descriptions	Examples
== (equal to)	This operator checks the value of two operands, if both are equal, then it returns true otherwise false.	(2 == 3) is not true.
!= (not equal to)	This operator checks the value of two operands, if both are not equal, then it returns true otherwise false.	(4!= 5) is true.
> (greater than)	This operator checks the value of two operands, if the left side of the operator is greater, then it returns true otherwise false.	(5 > 56) is not true.
< (less than)	This operator checks the value of two operands if the left side of the operator is less, then it returns true otherwise false.	(2 < 5) is true.

>= (greater than or equal to)	This operator checks the value of two operands if the left side of the operator is greater or equal, then it returns true otherwise false.	(12 >= 45) is not true.
<= (less than or equal to)	This operator checks the value of two operands if the left side of the operator is less or equal, then it returns true otherwise false.	(43 <= 43) is true.

Example: The following program is a simple example which demonstrates the relational operators.

```
public class RelationalOperator
{
        public static void main(String args[])
        {
            int p = 5;
            int q = 10;
            System.out.println("p == q = " + (p == q) );
            System.out.println("p != q = " + (p != q) );
            System.out.println("p > q = " + (p > q) );
            System.out.println("p < q = " + (p < q) );
            System.out.println("q >= p = " + (q >= p) );
            System.out.println("q <= p = " + (q <= p) );
    }
}
```

Output

```
p == q = false
p != q = true
p > q = false
p < q = true
q >= p = true
q <= p = false
```

Bitwise Operators

Java defines several bitwise operators, which can be applied to the integer types, long, int, short, char, and byte. Bitwise operator works on bits and performs the bit-by-bit operation. Assume if a = 60 and b = 13; now in binary format they will be as follows:

```
a = 0011 1100
b = 0000 1101
-----------------------
a&b = 0000 1100
a|b = 0011 1101
a^b = 0011 0001
~a = 1100 0011
```

Assume integer variable A holds 60 and variable B holds 13 then

Operator	Description	Example
& (bitwise and)	Binary AND Operator copies a bit to the result if it exists in both operands.	(A & B) will give 12 which is 0000 1100

| (bitwise or)	Binary OR Operator copies a bit if it exists in either operand.	(A | B) will give 61 which is 0011 1101
^ (bitwise XOR)	Binary XOR Operator copies the bit if it is set in one operand but not both.	(A ^ B) will give 49 which is 0011 0001
~ (bitwise compliment)	Binary Ones Complement Operator is unary and has the effect of 'flipping' bits.	(~A) will give -61 which is 1100 0011 in 2's complement form due to a signed binary number.
<< (left shift)	Binary Left Shift Operator. The left operands value is moved left by the number of bits specified by the right operand.	A << 2 will give 240 which is 1111 0000
>> (right shift)	Binary Right Shift Operator. The left operands value is moved right by the number of bits specified by the right operand.	A >> 2 will give 15 which is 1111
>>> (zero fill right shift)	Shift right zero fill operator, The left operands value is moved right by the number of bits specified by the right operand and shifted values are filled up with zeros.	A >>>2 will give 15 which is 0000 1111

Example: The following program is a simple example which demonstrates the bitwise operators.

```
class BitwiseOperator
{
  public static void main(String[] args)
  {
          int A = 10;
          int B = 3;
          int Y;
          Y = A & B;
          System.out.println(Y);
      Y = A | B;
          System.out.println(Y);
   Y = A ^ B;
          System.out.println(Y);
  }
}
```

Output:
2
11
9

Logical Operators

A logical operator (sometimes called a "Boolean operator") in Java programming is an operator that returns a Boolean result that's based on the Boolean result of one or two other expressions. Java supports following 3 logical operators.

Operator	Description	Example
&& (logical and)	If both the operands are non-zero, then the condition becomes true.	(0 && 1) is false
|| (logical or)	If any of the two operands are non-zero, then the condition becomes true.	(0 || 1) is true
! (logical not)	Logical NOT Operator Use to reverses the logical state of its operand. If a condition is true then Logical NOT operator will make false.	!(0 && 1) is true

Example: The following program is a simple example which demonstrates the Logical operators.

```
public class LogicalOperator
{
        public static void main(String args[])
    {
            boolean p = false;
            boolean q = true;
            System.out.println("p && q = " + (p&&q));
        System.out.println("p || q = " + (p||q));
        System.out.println("!(p && q) = " + !(p && q));
        }
}
```

Output

p && q = false
p || q = true
!(p && q) = true

Assignment Operators

The Java Assignment Operators are used when you want to assign a value to the expression. The assignment operator denoted by the single equal sign =. In a Java assignment statement, any expression can be on the right side and the left side must be a variable name. For example, this does not mean that "a" is equal to "b", instead, it means assigning the value of 'b' to 'a'. It is as follows:

Syntax:

```
variable = expression;
```

Assignment operators supported by Java are as follows:

Operator	Description	example
=	assigns values from right side operands to left side operand	A=B
+=	adds right operand to the left operand and assign the result to left	A+=B is same as A=A+B
-=	subtracts right operand from the left operand and assign the result to left operand	A-=B is same as A=A-B
*=	multiply left operand with the right operand and assign the result to left operand	A*=B is same as A=A*B
/=	divides left operand with the right operand and assign the result to left operand	A/=B is same as A=A/B
%=	calculate modulus using two operands and assign the result to left operand	A%=B is same as A=A%B
<<=	Left shift AND assignment operator.	A <<= 2 is same as A = A<< 2
>>=	Right shift AND assignment operator.	A >>= 2 is same as A = A >> 2
&=	Bitwise AND assignment operator.	A &= 2 is same as A = A & 2
^=	Bitwise exclusive OR and assignment operator.	A ^= 2 is same as A = A ^ 2
|=	Bitwise inclusive OR and assignment operator.	A |= 2 is same as A = A | 2

Example: Use of various assignments Operator

```
public class AssignmentOperator
{
    public static void main(String args[])
    {
        int a = 5;
        int b = 10;
        int c = 0;
        c = a + b;
        System.out.println("c = a + b = " + c );
        c += a;
        System.out.println("c += a  = " + c );
        c -= a;
        System.out.println("c -= a = " + c );
        c *= a ;
        System.out.println("c *= a = " + c );
        a = 10;
        c = 15;
        c /= a ;
        System.out.println("c /= a = " + c );
        a = 10;
```

```
            c = 15;
            c %= a ;
            System.out.println("c %= a  = " + c );
            c &= a ;
            System.out.println("c &= a  = " + c );
            c ^= a ;
            System.out.println("c ^= a  = " + c );
            c |= a ;
            System.out.println("c |= a  = " + c );
            c <<= 2;
            System.out.println("c <<= 2 = " + c );
            c >>= 2;
            System.out.println("c >>= 2 = " + c );
            c >>= 2;
            System.out.println("c >>= 2 = " + c );
    }
}
```

Output

```
c = a + b = 15
c += a  = 20
c -= a = 15
c *= a = 75
c /= a = 1
c %= a = 5
c &= a  = 0
c ^= a  = 10
c |= a  = 10
c <<= 2 = 40
c >>= 2 = 10
c >>= 2 = 2
```

Conditional operator or Ternary operator

If any operator is used on three operands or variable is known as ternary operator. It can be represented with " ?: ". It is also called as conditional operator. The ternary operator is an operator that takes three arguments. The first argument is a comparison argument, the second is the result upon a true comparison, and the third is the result upon a false comparison. Ternary operator is shortened way of writing an if-else statement. Ternary operator is a?b:c it say that the condition a is true b will be executed else c will be executed.

Syntax

expression-1? expression-2: expression-3

Example: use of ternary operator in Java

```
public class condiop .
{
    public static void main(String[] args)
        {
            String out;
            int  a = 6, b = 12;
            out = a==b ? "Yes":"No";
            System.out.println("Result= "+out);
    }
```

```
}
```

Output:

Result= No

Auto increment/Auto decrement operator

The operator (++) and the operator (--) are Java's increment and decrement operators. The increment (++) and decrement operator (--) are simply used to increase and decrease the value by one. The increment operator increases its operand by one and the decrement operator simply decreases its operand by one. For instance, the statement:

```
x = x + 1;
```

Can be rewritten like this by use of the increment operator i.e. ++:

```
x++;
```

Similarly, the statement:

x = x - 1: is equivalent to: x--;

Example: Use of auto increment and auto decrement in Java

```
public class AutoInc
{
    public static void main(String[] args)
        {
                int i = 1;
                System.out.println("i : " + i);
                System.out.println ("++i : " + ++i); // Pre-increment
                System.out.println ("i++ : " + i++); // Post-increment
                System.out.println("i : " + i);
                System.out.println ("--i : " + --i); // Pre-decrement
                System.out.println ("i-- : " + i--); // Post-decrement
                System.out.println ("i : " + i);
        }
}
```

Output:

```
i :1
++i: 2
i++: 2
i : 3
--i : 2
i-- : 2
i : 1
```

Miscellaneous Operators

Java's miscellaneous operators are: ternary operator, member access, comma, array index, new, instanceof, and typecast. These operators are explained below,

Conditional Operator (? :)

Conditional operator is also known as the ternary operator. This operator consists of three operands and is used to evaluate Boolean expressions. The goal of the operator is to decide which value should be assigned to the variable.

The operator is written as:

variable x = (expression)? Value if true: value if false

Example: Java program for use of ternary operator

```
public class Test
{
        public static void main(String args[])
        {
                int a , b;
                a = 10;
                b = (a ==1) ? 20 : 30;
                System.out.println("Value of b is : "+ b );
                b = (a ==10) ? 20 : 30;
                System.out.println("Value of b is : "+ b );
        }
}
```

Output:
Value of b is: 30
Value of b is: 20

Java Member Access Operator

The Java member access operator is a dot (.) symbol that is used to access data members and member methods of a class by its objects.

Java new Operator

The Java new operator is used to create a new object. Operator new is a Java keyword. It is followed by a call to a constructor, which initializes the new object. Note that declaring an object and creating an object are two different things. Simply declaring a reference variable does not create an object. For that, we need to use the new operator. The new operator creates an object by allocating memory to it and returns a reference to that memory location. The Java new operator needs a single, postfix argument: a call to a constructor. The name of the constructor provides the name of the class to instantiate. Following piece of code demonstrates the use of new operator.

Example:

```
class Universe
{
        public Universe()
        {
        }
        public void myUniverse()
        {
                System.out.println("This is my Universe");
        }
}
public class NewOperatorDemo
{
    public static void main(String[] args)
    {
        Universe newUniverse = new Universe();
        newUniverse.myUniverse();
    }
}
```

Output
This is my Universe

Java instance of Operator

Java instanceof operator also called type comparison operator compares an object to a specific type. It follows the syntax objRef instanceof type. Here objRef is the object name and the type is the name of object type whom objRef will be compared to. The equals() method of Java is a nice example that uses instanceof operator to check if two objects are equal. The following example (InstanceOfDemo.java) shows the use of Java instanceof operator.

4. Define loop. Write a java program to print first n prime numbers. [1+4]

Ans: Looping statements are the statements which execute a block of code repeatedly until some condition meet to the criteria. The block of statements can be executed any number of times, from zero to infinite number depending on the requirement. Loops can be considered as repeating if statements.

A loop in a program consists of two parts:

- Control statement
- Body of the loop

```
import java.util.*;
class Prime
{
    public static void main(String args[])
    {
    Scanner sc = new Scanner(System.in);
    int i, n, j, count;

    System.out.println("Enter the number of prime terms you want!");
    n=sc.nextInt();
    System.out.println("First "+n+" prime numbers are :-");
    for (int i = 1; i <= n; i++)
        {
            count = 0;
            for (int j = 2; j <= i / 2; j++)
                {
                    if (i % j == 0)
                        {
                            count++;
                            break;
                        }
                }
            if (count == 0)
                {
                    System.out.println(i);
                    }
        }
    }
}
```

5. **Differentiate between abstract class and interface with suitable example.** [5]

Ans: Abstract class and interface both are used to achieve abstraction where we can declare the abstract methods. Abstract class and interface both can't be instantiated. But there are many differences between abstract class and interface that are given below.

Abstract class	Interface
Abstract class can have abstract and non-abstract methods.	Interface can have only abstract methods. Since Java 8, it can have default and static methods also.
Abstract class doesn't support multiple inheritance.	Interface supports multiple inheritance.
Abstract class can have final, non-final, static and non-static variables.	Interface has only static and final variables.
Abstract class can provide the implementation of interface.	Interface can't provide the implementation of abstract class.
The abstract keyword is used to declare abstract class.	The interface keyword is used to declare interface.
An abstract class can extend another Java class and implement multiple Java interfaces.	An interface can extend another Java interface only.
An abstract class can be extended using keyword "extends".	An interface can be implemented using keyword "implements".
A Java abstract class can have class members like private, protected, etc.	Members of a Java interface are public by default.

Example:
public abstract class Shape
{
public abstract void draw();
}
	Example:
	public interface Drawable
	{
	void draw();
	}

6. **Define access modifier. Explain access modifiers in java with example.** [1+4]

Ans: Access modifiers (or access specifiers) are keywords in object-oriented languages that set the accessibility of classes, methods, and other members. Access modifiers are a specific part of programming language syntax used to facilitate the encapsulation of components.

There are two types of modifiers in java: **access modifiers** and **non-access modifiers**. The access modifiers in java specify accessibility (scope) of a data member, method, constructor or class. There are four types of java access modifiers:

1. private
2. default
3. protected
4. public

There are many non-access modifiers such as static, abstract, synchronized, native, volatile, transient etc. Here, we will learn access modifiers.

Private access modifier

The private access modifier is accessible only within class. In following example, we have created two classes A and Simple. A class contains private data member and private method. We are accessing these private members from outside the class, so there is compile time error.

```
class A
{
    private int data=40;
    private void Message()
    {
        System.out.prin+ln("Hello java");
    }
}
public class Simple
{
    public static void main(String args[])
    {
        A obj=new A();
        System.out.println(obj.data);//Compile Time Error
        obj.Message();//Compile Time Error
    }
}
```

Default access modifier

If you don't use any modifier, it is treated as **default** by default. The default modifier is accessible only within package. In following example, we have created two packages packA and packB. We are accessing the A class from outside its package, since A class is not public, so it cannot be accessed from outside the package.

```
//save by A.java
package packA;
class A
{
    void Message()
    {
        System.out.println("Hello");
    }
}

//save by B.java
package packB;
import packA.*;
class B
{
    public static void main(String args[])
    {
        A obj = new A();    //Compile Time Error
        obj.Message();      //Compile Time Error
    }
}
```

In the above example, the scope of class A and its method Message() is default so it cannot be accessed from outside the package.

Protected access modifier

The **protected access modifier** is accessible within package and outside the package but through inheritance only. The protected access modifier can be

applied on the data member, method and constructor. It can't be applied on the class. In following example, we have created the two packages packA and packB. The A class of packA package is public, so can be accessed from outside the package. But Message() method of this package is declared as protected, so it can be accessed from outside the class only through inheritance.

```
//save by A.java
package packA;
public class A
{
    protected void Message()
    {
            System.out.println("Hello");
    }
}

//save by B.java
package packB;
import packA.*;
class B extends A
{
    public static void main(String args[])
    {
            B obj = new B();
            obj.Message();
    }
}
```

Output: Hello

public access modifier

The **public access modifier** is accessible everywhere. It has the widest scope among all other modifiers.

Example: Java program showing use of public access modifier

```
//save by A.java
package packA;
public class A
{
    public void Message()
    {
            System.out.println("Hello");
    }
}
//save by B.java
package packB;
import packA.*;
class B
{
    public static void main(String args[])
    {
            A obj = new A();
```

```
        obj.Message();
    }
}
```

Output

Hello

Understanding all java access modifiers

Let's understand the access modifiers by a simple table.

Access Modifier	within class	within package	outside package by subclass only	outside package
Private	Y	N	N	N
Default	Y	Y	N	N
Protected	Y	Y	Y	N
Public	Y	Y	Y	Y

7. Define exception. Explain exception handling mechanism in java with example. [1+5]

Ans: An exception is a problem that arises during the execution of a program. When an Exception occurs the normal flow of the program is disrupted and the program/Application terminates abnormally, which is not recommended, therefore, these exceptions are to be handled. An exception can occur for many different reasons. Following are some scenarios where an exception occurs.

A user has entered an invalid data.

A file that needs to be opened cannot be found.

A network connection has been lost in the middle of communications or the JVM has run out of memory.

Some of these exceptions are caused by user error, others by programmer error, and others by physical resources that have failed in some manner.

Exception handling ensures that the flow of the program doesn't break when an exception occurs. For example, if a program has bunch of statements and an exception occurs mid-way after executing certain statements then the statements after the exception will not execute and the program will terminate abruptly. By handling we make sure that all the statements execute and the flow of program doesn't break.

Exception handling using Try Catch Block

Try block

The try block contains set of statements where an exception can occur. A try block is always followed by a catch block, which handles the exception that occurs in associated try block. A try block must be followed by catch blocks or finally block or both.

Syntax of try block

```
try
{
    //statements that may cause an exception
}
```

Catch block

A catch block is where you handle the exceptions; this block must follow the try block. A single try block can have several catch blocks associated with it. You can catch different exceptions in different catch blocks. When an exception occurs in try block, the corresponding catch block that handles that

particular exception executes. For example if an arithmetic exception occurs in try block then the statements enclosed in catch block for arithmetic exception executes.

Syntax of try catch

```
try
{
   //statements that may cause an exception
}
catch (exception(type) e(object))
{
   //error handling code
}
```

Example: The following is an array declared with 10 elements. Then the code tries to access the 11th element of the array which throws an exception.

```
import java.io.*;
public class ExcepTest
{
    public static void main(String args[])
    {
            try{
                    int a[] = new int[10];
             System.out.println("Access element three :" + a[11]);
            }
            catch (ArrayIndexOutOfBoundsException e)
            {
                    System.out.println("Exception thrown :" + e);
            }
            System.out.println("Out of the block");
    }
}
```

Output

Exception thrown: java.lang.ArrayIndexOutOfBoundsException: 11
Out of the block

Multiple Catch Blocks

A try block can be followed by one or more catch blocks. Each catch block must contain a different exception handler. So, if you have to perform different tasks at the occurrence of different exceptions, use java multi-catch block. The syntax for multiple catch blocks looks like the following:

Syntax

```
try
{
  // Protected code
}
catch (ExceptionType1 e1)
{
  // Catch block
}
catch (ExceptionType2 e2)
{
```

```
  // Catch block
}
catch (ExceptionType3 e3)
{
  // Catch block
}
```

Example: Program of java multi-catch block.

```
public class MultipleCatchBlock
{
        public static void main(String args[])
        {
                try{
                        int arr[]=new int[7];
                        arr[4]=30/0;
                        System.out.println("Last Statement of try block");
                    }
                  catch(ArithmeticException e)
                  {
        System.out.println("You should not divide a number by zero");
                }
                catch(ArrayIndexOutOfBoundsException e)
                {
        System.out.println("Accessing array elements outside of the limit");
                }
                catch(Exception e)
                {
                        System.out.println("Some Other Exception");
                }
                System.out.println("Out of the try-catch block");
        }
}
```

Output:

You should not divide a number by zero
Out of the try-catch block

In the above example, the first catch block got executed because the code we have written in try block throws ArithmeticException (because we divided the number by zero).

Now let's change the code a little bit and see the change in output:

```
class MultipleCatchBlock
{
        public static void main(String args[])
        {
                try{
                        int arr[]=new int[7];
                        arr[10]=10/5;
                System.out.println("Last Statement of try block");
                }
                catch(ArithmeticException e)
                {
```

```
System.out.println("You should not divide a number by zero");
                }
            catch(ArrayIndexOutOfBoundsException e)
            {
System.out.println("Accessing array elements outside of the limit");
            }
            catch(Exception e)
            {
            System.out.println("Some Other Exception");
            }
            System.out.println("Out of the try-catch block");
        }
}
```

Output:

Accessing array elements outside of the limit
Out of the try-catch block

In this case, the second catch block got executed because the code throws ArrayIndexOutOfBoundsException. We are trying to access the 11th element of array in above program but the array size is only 7.

Let's change the code again and see the output:

```
class MultipleCatchBlock
{
        public static void main(String args[])
        {
                try{
                        int arr[]=new int[7];
                        arr[10]=10/5;
                        System.out.println("Last Statement of try block");
            }
            catch(Exception e)
            {
                        System.out.println("Some Other Exception");
            }
            catch(ArithmeticException e)
            {
System.out.println("You should not divide a number by zero");
            }
            catch(ArrayIndexOutOfBoundsException e)
            {
System.out.println("Accessing array elements outside of the limit");
            }
            System.out.println("Out of the try-catch block");
        }
}
```

Output:

Compile time error: Exception in thread "main" java.lang.Error:
Unresolved compilation problems: Unreachable catch block for ArithmeticException. It is already handled by the catch block for Exception Unreachable catch block for ArrayIndexOutOfBoundsException. It is already

handled by the catch block for Exception at MultipleCatchBlock.main. This is because we placed the generic exception catch block at the first place which means that none of the catch blocks placed after this block is reachable. You should always place this block at the end of all other specific exception catch blocks.

8. Write short note on (any two) [2.5+2.5]

a) Final keyword

Ans: In Java, the **final** keyword is used to denote constants. It can be used with variables, methods, and classes. Once any entity (variable, method or class) is declared final, it can be assigned only once. That is,

- the final variable cannot be reinitialized with another value
- the final method cannot be overridden
- the final class cannot be extended

Final Variable in Java

A variable declared with a final keyword is known as a final variable. Final variable means a constant (value cannot be modified). When the final variable once initialized, the value of the final variable can never be changed. In other words, we cannot be assigned a new value.

A final variable can be used where we want to remain constant the value of a variable throughout the execution of a program. The only difference between a normal variable and a final variable is that we can re-assign value to a normal variable but we cannot re-assign the value of a final variable once assigned.

The syntax to declare a final variable in Java is as follows:

final data_type variable_name = value; //Just add a final keyword in front of definition.

For example:

```
final float pi = 3.14f;
```

Example: Use of final keyword in Java

```
public class FinalVariableEx
{
    // Declare a final instance variable.
        final int a = 20;
        void change()
        {
                a = 40;
                System.out.println(a);
                final int i = 0;
                for(i=0; i< 5; i++) // compile time error.
                {
                        System.out.println("Value of i: " +i);
                }
        }
    public static void main(String[] args)
    {
                FinalVariableEx fv = new FinalVariableEx();
                Fv.change();
        }
}
```

We got a compilation error problem in the above program because we tried to change the value of final variables a and i.

A final variable that is created inside the constructor, method, or block is known as a local final variable. It must be initialized once where it is created.

Final Method in Java

A method that is declared with the final keyword is known as final method in Java. A final method cannot be overridden in Java.

When a class is extended by another class, its method can be overridden for reuse but if we want to prevent a particular method being overridden, in this case, declare that method as final because a subclass can call the final method of superclass without any issues but it cannot override it. Any attempt to do so will cause a compilation problem.

Example:

```
public class FinalMethodEx
{
        FinalMethodEx()
        {
                System.out.println("This is a default constructor");
        }
        final int a = 50;
        final void show()
        {
                System.out.println("Value of a: " +a);
        }
}
public class FinalMethodExTest extends FinalMethodEx
{
        void show()
        {
  System.out.println("This is the final method of FinalMethodEx class");
        }
        public static void main(String[] args)
        {
                FinalMethodEx fm = new FinalMethodEx();
                fm.show();
        }
}
```

The main difference between abstract method and final method is that abstract method must be overridden in the subclass but final method cannot be overridden in the subclass.

Final Class in Java

A class that is declared with a final keyword is known as final class. Final class means restricting inheritance. It does not allow itself to be inherited by another class. In other words, Java classes declared as a final cannot be extended (inherited). If you do not want to be a subclass, declare it final. A lot of classes in Java API are final.

Example:

```
public final class FinalClassTest
{
        void show()
        {
```

```
                System.out.println("Final class cannot be inherited");
        }
}
public class FinalClassDemo extends FinalClassTest
{
        public static void main(String[] args)
        {
                FinalClassTest fc = new FinalClassTest ();
                fc.show();
        }
}
```

b) . collection class

Ans: Java collection class is used exclusively with static methods that operate on or return collections. It inherits Object class. The important points about Java Collections class are:

- Java Collection class supports the polymorphic algorithms that operate on collections.
- Java Collection class throws a NullPointerException if the collections or class objects provided to them are null.

Java Collections Example

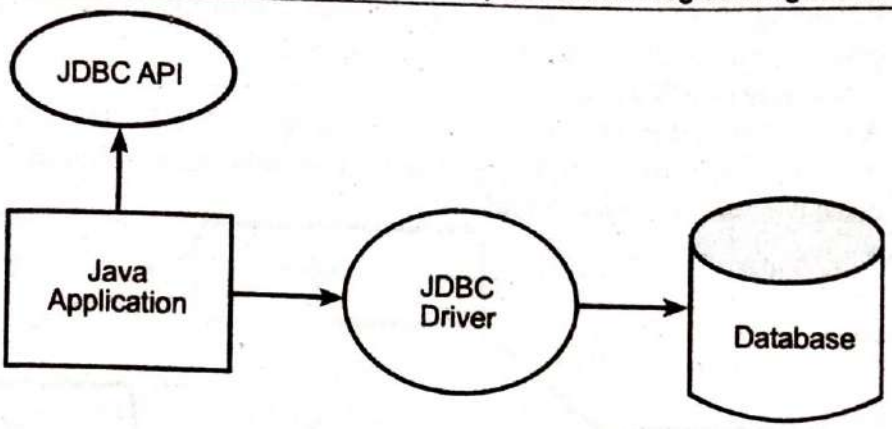
```
import java.util.*;
public class CollectionsExample
{
  public static void main(String a[])
  {
    List<String> list = new ArrayList<String>();
    list.add("C");
    list.add("Core Java");
    list.add("Advance Java");
    System.out.println("Initial collection value:"+list);
    Collections.addAll(list, "Servlet","JSP");
    System.out.println("After adding elements collection value:"+list);
    String[] strArr = {"C#", ".Net"};
    Collections.addAll(list, strArr);
    System.out.println("After adding array collection value:"+list);
  }
```

c) .JDBC

Ans: JDBC stands for Java Database Connectivity. JDBC is a Java API to connect and execute the query with the database. It is a part of JavaSE (Java Standard Edition). JDBC API uses JDBC drivers to connect with the database. There are four types of JDBC drivers:

- JDBC-ODBC Bridge Driver,
- Native Driver,
- Network Protocol Driver, and
- Thin Driver

We can use JDBC API to access tabular data stored in any relational database. By the help of JDBC API, we can save, update, delete and fetch data from the database. It is like Open Database Connectivity (ODBC) provided by Microsoft.



Group C

Attempt any TWO questions. **[2x10 = 20]**

9. a) Write a program to create and use java package. [5]

Ans:

```
//save by ClassA.java
package pack;
public class ClassA
{
    public void Display()
    {
        System.out.println("I am within the ClassA of package pack ");
    }
}
//save by ClassB.java
package mypack;
import pack.*;
class ClassB
{
        public static void main(String args[])
        {
                ClassA obj = new ClassA();
                obj.Display();
        }
}
```

Output:

I am within the ClassA of package pack

b) Define thread. Explain the life cycle of thread. [1+4]

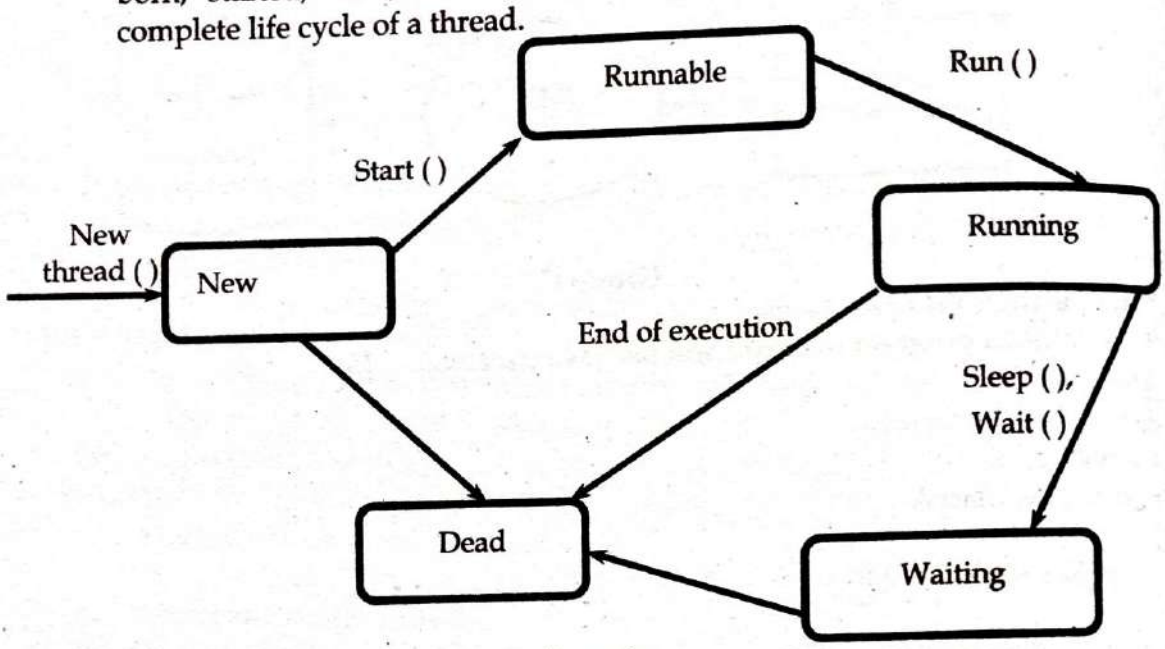
Ans: Java is a multi-threaded programming language which means we can develop multi-threaded program using Java. A multi-threaded program contains two or more parts that can run concurrently and each part can handle a different task at the same time making optimal use of the available resources especially when your computer has multiple CPUs.

By definition, multitasking is when multiple processes share common processing resources such as a CPU. Multi-threading extends the idea of multitasking into applications where you can subdivide specific operations within a single application into individual threads. Each of the threads can run in parallel. The OS divides processing time not only among different applications, but also among each thread within an application. Multi-

threading enables us to write in a way where multiple activities can proceed concurrently in the same program.

Life Cycle of a Thread

A thread goes through various stages in its life cycle. For example, a thread is born, started, runs, and then dies. The following diagram shows the complete life cycle of a thread.



Following are the stages of the life cycle:

- **New:** A new thread begins its life cycle in the new state. It remains in this state until the program starts the thread. It is also referred to as a born thread.
- **Runnable -** After a newly born thread is started, the thread becomes runnable. A thread in this state is considered to be executing its task.
- **Waiting –** Sometimes, a thread transitions to the waiting state while the thread waits for another thread to perform a task. A thread transitions back to the runnable state only when another thread signals the waiting thread to continue executing.
- **Timed Waiting –** A runnable thread can enter the timed waiting state for a specified interval of time. A thread in this state transition back to the runnable state when that time interval expires or when the event it is waiting for occurs.
- **Terminated (Dead) –** A runnable thread enters the terminated state when it completes its task or otherwise terminates.

10. a). Write a program to sort name of any five cities in ascending order. [5]

Ans:

```
import java.util.Scanner;
public class JavaExample
{
  public static void main(String[] args)
  {
    String temp;
    String str[ ] = new String[count];
    Scanner sc = new Scanner(System.in);
    //User is entering the cities and they are stored in an array
```

```
    System.out.println("Enter the Strings one by one:");
    for(int i = 0; i < 5; i++)
    {
      str[i] = sc.nextLine();
    }
    sc.close();
    //Sorting the cities
    for (int i = 0; i < 5; i++)
    {
      for (int j = i + 1; j < 5; j++)
      {
        if (str[i].compareTo(str[j])>0)
        {
          temp = str[i];
          str[i] = str[j];
          str[j] = temp;
        }
      }
    }
    //Displaying the cities after sorting them based on alphabetical order
    System.out.print("Cities in Sorted Order:");
    for (int i = 0; i < 5 ; i++)
    {
      System.out.print(str[i] + ", ");
    }
  }
}
```

b). Define polymorphism. How do we achieve polymorphism in java explain with example? [1+4]

Ans: In Java, polymorphism refers to the ability of a class to provide different implementations of a method, depending on the type of object that is passed to the method. To put it simply, polymorphism in Java allows us to perform the same action in many different ways.

Polymorphism in Java can be achieved in two ways i.e., method overloading and method overriding. Polymorphism in Java is mainly divided into two types.

- Compile-time polymorphism
- Runtime polymorphism

Compile-time polymorphism can be achieved by method overloading, and Runtime polymorphism can be achieved by method overriding.

Polymorphism in Java Example

```
class Parent
{
        // creating print method
        void print()
        {
            System.out.println("Hi I am parent");
        }
}
```

```
// Child class extends Parent class
class Child extends Parent
{
        // overriding print method
        void print()
        {
            System.out.println("Hi I am children");
        }
}
// Overload class to illustrate compile-time polymorphism
class Overload
{
        // Creating a statement method
        void statement(String name)
        {
            System.out.println("Hi myself " + name);
        }
        // overloading statement method
        void statement(String fname, String lname)
        {
            System.out.println("Hi myself " + fname + " " + lname);
        }
}
public class Main
{
 public static void main(String[ ] args)
 {
  // creating instance of parent
  Parent obj1;
  obj1 = new Parent();
  obj1.print();
  obj1 = new Child();
  obj1.print();
  // creating instance of overload
  Overload obj2 = new Overload();
  obj2.statement("Sohan.");
  obj2.statement("Sohan", "Bhatt.");
 }
}
```

Output

Hi I am a parent
Hi I am children
Hi myself Sohan.
Hi myself Sohan Bhatt

11. a). Differentiate between java AWT and java Swing. Explain the different type's layout managers in java GUI programming. [2+3]

Ans: Difference between AWT and Swing:

AWT	Swing
Java AWT is an API to develop GUI applications in Java	Swing is a part of Java Foundation Classes and is used to create various applications.
The components of Java AWT are heavy weighted.	The components of Java Swing are light weighted.
Java AWT has comparatively less functionality as compared to Swing.	Java Swing has more functionality as compared to AWT.
The execution time of AWT is more than Swing.	The execution time of Swing is less than AWT.
The components of Java AWT are platform dependent.	The components of Java Swing are platform independent.
MVC pattern is not supported by AWT.	MVC pattern is supported by Swing.
AWT provides comparatively less powerful components.	Swing provides more powerful components.

Java LayoutManagers

The LayoutManagers are used to arrange components in a particular manner. The Java LayoutManagers facilitates us to control the positioning and size of the components in GUI forms. LayoutManager is an interface that is implemented by all the classes of layout managers. There are the following classes that represent the layout managers:

- java.awt.BorderLayout
- java.awt.FlowLayout
- java.awt.GridLayout
- java.awt.CardLayout
- java.awt.GridBagLayout
- javax.swing.BoxLayout
- javax.swing.GroupLayout
- javax.swing.ScrollPaneLayout
- javax.swing.SpringLayout etc.

Java BorderLayout

The BorderLayout is used to arrange the components in five regions: north, south, east, west, and center. Each region (area) may contain one component only. It is the default layout of a frame or window. The BorderLayout provides five constants for each region:

public static final int NORTH
public static final int SOUTH
public static final int EAST
public static final int WEST
public static final int CENTER

Constructors of BorderLayout class:

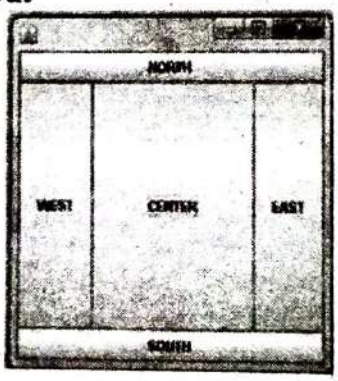
- BorderLayout(): creates a border layout but with no gaps between the components.

- BorderLayout(int hgap, int vgap): creates a border layout with the given horizontal and vertical gaps between the components.

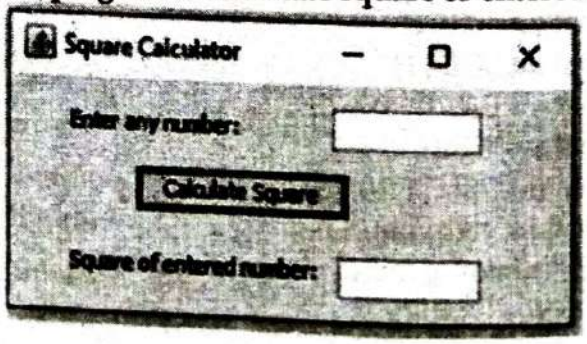
Example of BorderLayout class: Using BorderLayout() constructor

```
import java.awt.*;
import javax.swing.*;
public class Border
{
JFrame f;
Border()
{
  f = new JFrame();
   // creating buttons
  JButton b1 = new JButton("NORTH");
  JButton b2 = new JButton("SOUTH");
  JButton b3 = new JButton("EAST"); // the button will be labeled as EAST
  JButton b4 = new JButton("WEST"); // the button will be labeled as WEST
  JButton b5 = new JButton("CENTER");
  f.add(b1, BorderLayout.NORTH);
  f.add(b2, BorderLayout.SOUTH);  / b2 will be placed in the South Direction
  f.add(b3, BorderLayout.EAST);  // b2 will be placed in the East Direction
  f.add(b4, BorderLayout.WEST);  // b2 will be placed in the West Direction
  f.add(b5, BorderLayout.CENTER);  // b2 will be placed in the Center
  f.setSize(300, 300);
  f.setVisible(true);
}
public static void main(String[ ] args)
{
    new Border();
  }
}
```

Output



b) Write a java GUI program to calculate square of entered number. [5]

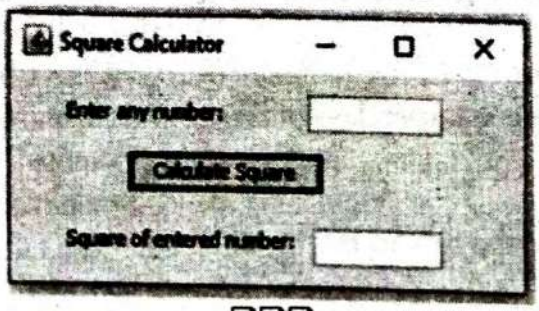


Ans:

```
import javax.swing.*;
import java.awt.*;
import java.awt.event.*;
public class EventTest extends JFrame implements ActionListener
{
        private JTextField t1, t2;
        JLabel l1,l2;
        JButton b1;
        public EventTest()
        {
                super("Handling Action Event");
                setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

                l1 = new JLabel("Enter any number:");
                l2 = new JLabel("Square of entered number:");
                t1 = new JTextField(10);
                t2 = new JTextField(10);
                b1 = new JButton("Calculate Square");
                b1.addActionListener(this);
                setLayout(new FlowLayout(FlowLayout.LEFT,150,10));
                add(l1);
                add(t1);
                add(l2);
                add(t2);
                add(b1);
                setSize(400,300);
                setVisible(true);
        }
        public void actionPerformed(ActionEvent ae)
        {
                int n, result;
                n = Integer.parseInt(t1.getText());
                if(ae.getActionCommand() == "Calculate square")
                        result = n*n
                t2.setText(String.valueOf(result));
        }
        public static void main(String a [])
        {
                new EventTest();
        }
}
```

Output



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MODEL QUESTIONS SETS FOR PRACTICE

MODEL SET 1

Bachelor in Computer Applications | **Full Marks:** 60
Course Title: OOPS in Java | **Pass Marks:** 24
Course Code: CACS 204 | **Time:** 3 hr.
Semester: III

Candidates are required to answer the questions in their own words as far as possible.

Section A

Attempt all the questions. **(10 × 1 = 10)**

1. Circle (O) the correct answer.

i. Java Source Code is compiled into .....
   a) Source Code b) Exe
   c) Obj d) Bytecode

ii. Which of the following is smallest integer data type?
   a) long b) short
   c) byte d) int

iii. If private members are to be called outside the class, which is a good alternative?
   a) Call a public member function which calls private function
   b) Call a private member function which calls private function
   c) Call a protected member function which calls private function
   d) Not possible

iv. A package is a collection of
   a) Classes b) interfaces
   c) editing tools d) classes and interfaces

v. Which of the following classes can catch all exceptions which cannot be caught?
   a) RuntimeException b) Error
   c) Exception d) ParentException

vi. Which of the following handles the exception when a catch is not used?
   a) finally b) throw handler
   c) default handler d) java run time system

vii. Which of these class is superclass of String and StringBuffer class?
   a) java.util b) java.lang
   c) ArrayList d) None of the mentioned

viii. Default value of a java thread is.....
   a. 0 b. 1
   c. 5 d. 10

ix. Which of these streams contains the classes which can work on character stream?

a. InputStream
b. OutputStream
c. Character Stream
d. All of the mentioned

x. Which of these classes is not part of Java's collection framework?

a. Maps
b. Array
c. Stack
d. Queue

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. What is a Result Set? Explain different types of Result Set object with example
3. What is the difference between an Applet and a Java Application? Explain the life cycle of an Applet.
4. Write a simple Java Swing program to create a JButton and adding it on the JFrame object inside the main() method
5. Which collection classes provide random access of its elements?
6. Can we import same package/class twice? Will the JVM load the package twice at runtime? Explain the usage of Java packages.
7. What are input and output streams? Explain them with illustrations.
8. How inter thread communication is possible between multiple threads. Explain with suitable example.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. a) Write a Java program to compare a given string to the specified string buffer.
   b) What is the difference between checked and unchecked exceptions in Java?
10. a) What are the uses of super keyword in java? Explain their uses with suitable example.
    b) Write a program to print the area and perimeter of a triangle having sides of 3, 4 and 5 units by creating a class named 'Triangle' with constructor having the three sides as its parameters.
11. a) Define switch statement. Write down their syntax and explain with suitable example.
    b) Describe the basic structure of java program. And explain each of the parts.

MODEL SET 2

Section A

Attempt all the questions. **(10 × 1 = 10)**

1. **Circle (O) the correct answer.**

i. Which of the tool is used to compile java code?

a. javadoc
b. jar
c. javac
d. java

ii. Which of the following is not a primitive data type?

a. byte
b. short
c. int
d. enum

iii. The static member functions _____
   a) Have access to all the members of a class
   b) Have access to only constant members of a class
   c) Have access to only the static members of a class
   d) Have direct access to all other class members also10.

iv. The Date class includes within ..... package.
   a) java.io b) java.awt
   c) java.net d) java.util

v. What exception thrown by parseInt() method?
   a) ArithmeticException b) ClassNotFoundException
   c) NullPointerException d) NumberFormatException

vi. Which of these operators can be used to concatenate two or more String objects?
   a) + b) +=
   c) & d) | |

vii. Which statements is/are correct
   a. On calling Thread start () method a new thread get created.
   b. Thread start () method call run () method internally
   c. Thread run () method can also be called directly to create thread.
   d. All correct

viii. Which of these classes is used to read characters in a file?
   a) FileReader b) FileWriter
   c) FileInputStream d) InputStreamReader

ix. Which of these interfaces must contain a unique element?
   a) Set b) List
   c) Array d) Collection

x. What is Collection in Java?
   a) A group of objects b) A group of classes
   c) A group of interfaces d) None of the mentioned

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. What do you mean by JVM? Explain their working mechanism.
3. Define for-each looping statement with suitable example. Also how it is differ from for looping statement.
4. What is Runtime polymorphism or Dynamic method dispatch in java?
5. How can you handle an exception? What is the purpose of the throw and throws keywords?
6. Difference between String, String Buffer and String Builder?
7. What do you know about **RandomAccessFile**? Explain with suitable example.
8. What are adapter classes? Explain with some adapter classes.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. a) How do you classify Swing Components? What is the difference between swing and AWT?
   b) What is serialization and de-serialization? Explain with suitable example.
10. a) How do you classify Swing Components?
   b) What is the difference between swing and AWT?

11. a) Write a program called Fibonacci to print the first 20 Fibonacci numbers F(n), where F(n)=F(n-1)+F(n-2) and F(1)=F(2)=1. Also compute their average.

b) How inter thread communication is possible between multiple threads. Explain with suitable example.

Section A

Attempt all the questions. **(10 × 1 = 10)**

1. Circle (O) the correct answer.

i. Which of the following tool used to execute java code?

a) javadoc b) javac
c) rmic d) java

ii. Character data type cannot store following value.

a) Letter b) String
c) Special Character d) Digit

iii. How many private member functions are allowed in a class?

a) Only 1 b) Only 7
c) Only 255 d) As many as required

iv. An ..... is an incomplete class that requires further specification.

a) abstract class b) final class
c) static class d) super class

v. Which of these class is related to all the exceptions that cannot be caught?

a) Error b) Exception
c) RuntimeExecption d) All of the mentioned

vi. Which of this method of class String is used to obtain a length of String object?

a) get() b) Sizeof()
c) lengthof() d) length()

vii. How many ways a thread can be created in Java multithreading?

a) 1 b) 2
c) 3 d) 4

viii. Which of these method of FileReader class is used to read characters from a file?

a) read() b) scanf()
c) get() d) getInteger()

ix. Which of these is Basic interface that all other interface inherits?

a) Set b) Array
c) List d) Collection

x. How many types of controls does AWT support?

a) 7 b) 6
c) 5 d) 8

Group B

Attempt any SIX questions. [6x5 = 30]

2. What is recursion? Write a program in Java to find factorial of given number by using recursion.
3. Differentiate between abstract class and interface with suitable example.
4. Write a GUI program in java that reads the line of text from the file data.txt into a text area. Modify the text into the upper case and save these text into the file upper.txt while clicking the modify button.
5. Develop an applet that receives three numeric values as input from the user and then display the largest of three on the screen. Write a HTML page and test the applet.
6. What is method overriding? How it is differ from method overloading? Explain
7. Differentiate between the Thread class and Runnable interface for creating a Thread?
8. By using the sequential search algorithm, write a Java program to search for an element of an integer array of 10 elements.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. What is exception handling? Discuss exception handling in detail with suitable example.
10. Write a program using swing components to multiply two numbers. Use text fields for inputs and outputs. Your program should display the result when the user presses a button.
11. What is java Beans? How is it different from other java classes? Discuss property design patterns with suitable example of each.

MODEL SET 4

Section A

Attempt all the questions. **(10 × 1 = 10)**

1. Circle (O) the correct answer.

i. Java Programming was designed by .....
   a) Microsoft b) Mozilla Corporation
   c) Sun Microsystems d) Amazon Inc.

ii. What is Literal in Java Programming?
   a) special type of class
   b) source code representation of a fixed value
   c) special type of data type
   d) None of these

iii. What is it called where object has its own lifecycle and child object cannot belong to another parent object?
   a) Aggregation b) Composition
   c) Encapsulation d) Association

iv. Which is private member functions access scope?
   a) Member functions which can only be used within the class
   b) Member functions which can used outside the class
   c) Member functions which are accessible in derived class
   d) Member functions which can't be accessed inside the class

v. The ..... keyword is used to derive a class from a super-class.
   a) adds b) extends
   c) duplicate d) inherit

vi. Which of these class is related to all the exceptions that can be caught by using catch?
a) Error
b) Exception
c) RuntimeExecption
d) All of the mentioned

vii. Which of these method of class String is used to extract a single character from a String object?
a) CHARAT()
b) chatat()
c) charAt()
d) ChatAt()

viii. Which function of pre defined class Thread is used to check weather current thread being checked is still running?
a) isAlive()
b) Join()
c) isRunning()
d) Alive()

ix. Which of these class can be used to implement the input stream that uses a character array as the source?
a) BufferedReader
b) FileReader
c) CharArrayReader
d) FileArrayReader

x. Which is the container that doesn't contain title bar and MenuBars but it can have other components like button, textfield etc?
a) Window
b) Frame
c) Panel
d) Container

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. What is "this" keyword in java? Explain with suitable example.
3. What is a package in Java? List down various advantages of packages
4. Differentiate between JDK, JRE, and JVM.
5. Explain the difference between the inner class and the subclass.
6. Difference between Default and Protected access specifiers.
7. Difference between Abstract class and Interface.
8. Difference between start() and run() method of thread class.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. Write a program using swing components to add two numbers. Use text fields for inputs and output. Your program should display the result when the user presses a button.
10. What are exceptions? Why is it important to handle exceptions? Discuss different keywords that are used to handle exception.
11. a) Discuss the use of multithreading with suitable example.
    b) Discuss the use of interface to achieve multiple inheritance.

MODEL SET 5

Section A

Attempt all the questions. **(10 × 1 = 10)**

1. **Circle (O) the correct answer.**

i. Earlier name of Java Programming language was....
a) A D
b) OAK
c) Eclipse
d) Netbean

ii. Which type of literal is written in pair of single quote?
a) Character b) Boolean
c) Float d) Integer

iii. What is it called where child object gets killed if parent object is killed?
a) Aggregation b) Composition
c) Encapsulation d) Association

iv. If a class that implements an interface does not implement all the methods of the interface, then the class becomes a/an ..... class.
a) abstract b) final
c) static d) super

v. Which of these is a super class of all exceptional type classes?
a) String b) RuntimeExceptions
c) Throwable d) Cacheable

vi. Which of these constructors is used to create an empty String object?
a) String() b) String(void)
c) String(0) d) None of the mentioned

vii. Which of these method of Thread class is used to Suspend a thread for a period of time?
a) sleep() b) terminate()
c) suspend() d) stop()

viii. Which of these classes can return more than one character to be returned to input stream?
a) BufferedReader b) Bufferedwriter
c) PushbachReader d) CharArrayReader

ix. Which of these keywords is used to define interfaces in Java?
a) interface b) Interface
c) intf d) Intf

x. Give the abbreviation of AWT?
a. Applet Windowing Toolkit b) Abstract Windowing Toolkit
c. Absolute Windowing Toolkit d) None of the above

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. Why concept of interface is important? How multiple inheritance is supported by interface? Explain with suitable example.
3. When the exception handling constructs throws and finally is important? Explain both of them with suitable example.
4. Write a program to read ID, Name, address, salary of 10 students from keyboard and write into the file "emp.doc". Again read records of the employees and display records of those students whose salary is more than 25000.
5. Why adapter classes are important? Compare it with listener interface with suitable example.
6. What is internal frame? Write a program that displays an internal frame within some parent frame.
7. What is JDBC? How do you execute SQL statements in JDBC?
8. Discuss the use of multithreading with suitable example.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. a) Discuss any five classes to handle files in java.
   b) Discuss grid layout with suitable example.

10. Write a program using swing components to multiply two numbers. Use text fields for inputs and output. Your program should display the result when the user press a button.

11. a) Discuss the role of event listeners to handle events with suitable example.

    b) What is JDBC? Discuss different driver types of JDBC.

MODEL SET 6

Section A

Attempt all the questions. **(10 × 1 = 10)**

1. Circle (O) the correct answer.

i. Which of the following personality is called as father of Java Programming language?
   a) Larry Page b) James Gosling
   c) Bjarne Stroustrup d) None of these

ii. Which of these selection statements test only for equality?
   a) if b) switch
   c) if & switch d) none of the mentioned

iii. What is it called if an object has its own lifecycle and there is no owner?
   a) Aggregation b) Composition
   c) Encapsulation d) Association

iv. By convention, java packages begin with ..... letters while all the class names begin with an ..... letter.
   a) uppercase, uppercase b) lowercase, lowercase
   c) uppercase, lowercase d) lowercase, uppercase

v. Which of these keywords is used to manually throw an exception?
   a) try b) finally
   c) throw d) catch

vi. Which of these is an incorrect statement?
   a) String objects are immutable, they cannot be changed
   b) String object can point to some other reference of String variable
   c) StringBuffer class is used to store string in a buffer for later use
   d) None of the mentioned

vii. Which method must be implemented by a Java thread?
   a. run() b. execute()
   c. start() d. None

viii. Which of these classes are used by Byte streams for input and output operation?
   a. Inputstream b. Inputoutputstream
   c. Reader d. All of the mentioned

ix. Which of these access specifiers can be used for a class so that its members can be accessed by a different class in the different package?
   a) Public b) Protected
   c) Private d) No Modifier

x. Which of the following package stores all the standard java classes?
   a) lang b) java
   c) util d) java.packages

Group B

Attempt any SIX questions. [6x5 = 30]

2. Discuss the use of interfaces to achieve multiple inheritance.
3. Discuss any five classes to handle files in java.
4. How can you handle events using adapter classes? Discuss.
5. Discuss any 5 exception classes in java.
6. What is JDBC? How do you execute SQL queries in JDBC?
7. Discuss the role of event listeners to handle events with suitable example.
8. What is multithreading? Why is it important to develop computer programs? Discuss life cycle of thread in detail.

Group C

Attempt any TWO questions. 2x10 = 20]

9. Write a program using swing components to find simple interest. Use text fields for inputs and output. Your program should display the result when the user presses a button.
10. What is layout management? Discuss any three layout management classes with examples of each.
11. Write a java program using JDBC to extract name of those students who live in Kanchanpur district, assuming that the student table has four attributes (ID, name, District and age).

MODEL SET 7

Section A

Attempt all the questions. (10 × 1 = 10)

1. **Circle (O) the correct answer.**

i. Why OAK was renamed to Java?
   a) because the name was not relevant to the language they created
   b) None of these
   c) Because there was another language called Oak
   d) Because the language was unsuccessful, so they created another version and changed its name to java.

ii. Which of the following loops will execute the body of loop even when condition controlling the loop is initially false?
   a) do-while
   b) while
   c) for
   d) none of the mentioned

iii. When does method overloading is determined?
   a) At run time
   b) At compile time
   c) At coding time
   d) At execution time

iv. A class member declared protected becomes a member of subclass of which type?
   a) public member
   b) private member
   c) protected member
   d) static member

v. Which of these keywords must be used to handle the exception thrown by try block in some rational manner?
   a) try
   b) finally
   c) throw
   d) catch

vi. Which of these method of String class can be used to test to strings for equality?
   a) isequal()
   b) isequals()
   c) equal()
   d) equals()

vii. What is maximum thread priority in Java?
a) 10 b) 12
c) 5 d) 8

viii. Which of these classes are used by character streams for input and output operations?
a) Inputstream b) Writer
c) Readstream d) Inputoutputstream

ix. Which of this access specifies can be used for a class so that its members can be accessed by a different class in the same package?
a) Public b) Protected
c) No Modifier d) All of the mentioned

x. Which is used to store data and partial results, as well as to perform dynamic linking, return values for methods, and dispatch exceptions?
a. Window b. Panel
c. Frame d. Container

Group B

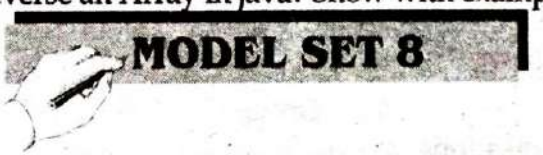
Attempt any SIX questions. **[6x5 = 30]**

2. Write a simple java program to read from and write to file.
3. Write a program in java to find the area of circle.
4. What is socket? Differentiate TCP socket from UDP socket.
5. What is the difference between equals() and == in Java?
6. What are wrapper classes in Java? Explain with suitable example.
7. Explain public static void main(String args[]) in Java.
8. What is the difference between Array list and vector in Java?

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. What is static variable in Java? Write a program in java to count number of objects created within the program by using the concept of static variable.
10. What are differences between Swing and AWT? Why Swing components are called lightweight component?
11. a) There are two arrays object one containing 100 elements and another containing 50 elements. Both are of same data type. Can we assign one Array to another array? Explain with suitable practical example.
    v) How to reverse an Array in java? Show with example.



Section A

Attempt all the questions. **(10 × 1 = 10)**

1. **Circle (O) the correct answer.**

i. Following file is human readable in Java programming language.
a) Obj b) Java c) Class d) Jar

ii. Which of these jump statements can skip processing the remainder of the code in its body for a particular iteration?
a) break b) return c) exit d) continue

iii. Which of these are selection statements in Java?
a) if() b) for() c) Continue d) break

iv. Which of the following is a type of polymorphism in Java?
a) Compile time polymorphism b) Execution time polymorphism
c) Multiple polymorphism d) Multilevel polymorphism

v. Which of these is correct way of inheriting class A by class B?
   a) class B + class A {}
   b) class B inherits class A {}
   c) class B extends A {}
   d) class B extends class A {}

vi. Which of these keywords is not a part of exception handling?
   a) try
   b) finally
   c) thrown
   d) catch

vii. Which of the following statements are incorrect?
   a) String is a class
   b) Strings in java are mutable
   c) Every string is an object of class String
   d) Java defines a peer class of String, called StringBuffer, which allows string to be altered

viii. String in Java is a?
   a) class
   b) object
   c) variable
   d) character array

ix. Which method is called internally by Thread start() method?
   a) execute()
   b) run()
   c) launch()
   d) main()

x. Which of the following methods not included in OutputStream class.
   a) write( )
   b) skip( )
   c) close( )
   d) flush( )

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. What is the relationship between an event-listener interface and an event-adapter class?
3. What advantage do Java's layout managers provide over traditional windowing systems?
4. Which method do you use to enable and disable components such as JButtons? What class is it defined in?
5. How do you read from a file using FileReader class? Explain with suitable example.
6. Write a program to throw ArrayOutOfBoundsException?
7. Describe the basic structure of java program. And explain each of the parts.
8. Compare for, for-each, while and do...while looping statements with suitable example.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. a) What is array? Write a program to find second largest element in a given Array in java?
   b) What is constructor? Describe different types of constructors used in java with example.
10. a) Name the containers which use Border Layout as their default layout?
   b) What is a layout manager and what are different types of layout managers available in java Swing?
11. a) Differentiate between process and thread?
   b) What are the states in the lifecycle of a Thread? Explain.

❑❑❑

System Analysis and Design

Course code: CACS203 **Year / Semester:** II/III

Course Title: System Analysis and Design

Class load: 4 hrs. /Weak (**Theory:** 3 Hrs. **Practical:** 3 Hrs.)

Course Description:

This course mainly focuses on different aspect of system analysis and design such as foundation, planning, analysis, design, implementation and maintenance.

Course Objectives

The general objective of this course is to provide concepts related to information systems development in a systematic approach including foundations, planning, analysis, design, implementation and maintenance.

Course Content

Unit 1 System Development Fundamentals **9Hrs.**

a. **The Systems Development Environment**

Introduction, Modern Approach of System Analysis and Design, Information System and its Type, Developing Information Systems and the Systems Development Life Cycle, The I leart of the Systems Deve1opmcnt Process, The Traditional Wate1fall SDLC, Approaches for Improving Development, CASE Tools, Rapid Application Development, Service-Oriented Architecture, Agile Methodologies, extreme Programming, Object- Oriented Analysis and Design

b. **The Origins of Software**

Introduction, System Acquisition, Reuse

c. **Managing the Information Systems Project**

Introduction, Managing Information Systems Project, Representing and Scheduling Project Plans, Using Project Manugemcn1 Software

U nit 2 Planning **7 Hrs.**

a. **System Development Projects: Identification and Selection**

Introduction, Identifying and Selecting Systems Development Projects, Corporate and Information Systems Planning

b. **System Development Projects: Initiation and Planning**

Introduction, Initiating and Planning Systems Development Projects, Process of Initiating• and Plan ling IS Development Projects. Assessing Project Feasibility. Building and Reviewing the Baseline Project Plan

Unit 3 Analysis

a. **System Requirements** **13 Hrs.**

Introduction, Performing Requirements Determination, Traditional Methods for Determining Requirements, Contemporary Methods for Determining System Requirements, Radical Methods training System Requirements, Requirements Management Tools, Requirements Determination Using Agile Methodologies

b. **System Process Requirements**

Introduction, Process Modeling, Data Flow Diagramming Mechanic, Using Data Flow Diagramming in the Analysis Process. Modeling Logic with Decision Tables

c. **System Data Requirements**

Introduction, Conceptual Data Modeling, Gathering Information for Conceptual Data Modeling, Introduction to E-R Modeling, Conceptual Data Modeling and the E-R Model, Representing Super-types and Sub-types, Business Rules, Rock of Packaged Conceptual Data Models - Database Patterns

Unit 4 Design **12 Hrs.**

a. **Designing Databases**

Introduction, Database Design, Relational Database Model, Normalization, Transforming E-R Diagrams into Relations, Merging Relations, Physical File and Database Design. Designing Fields, Designing Physical Tables

b. **Designing Forms and Reports**

Introduction, Designing Forms and Reports, Formatting Forms and Reports, Assessing Usability

c. **Designing Interfaces and Dialogues**

Introduction, Designing Interfaces and Dialogues, Interaction Methods and Devices, Designing Interfaces and Dialogues in Graphical Environments

Unit 5 Implementation and Maintenance **4 Hrs.**

a. **System Implementation**

Introduction, System implementation, Software Application Testing, Installation, Documenting

The System, Training and Supporting Users, Organizational Issues in Systems Implementation

b. **System Maintenance**

Introduction, maintaining information Systems, Conducting Systems Maintenance

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
40	-	60 (3 Hrs)		100

Text Book

1. Jeffrey A. Hoffer, Joey George, Joe Valacich, "Modern Systems Analysis and Design", 6/E, Prentice Hall India.
2. Jeffery Whitten, Lonnie Bentley, "Systems Analysis and Design Methods", 7/E, MeGraw-Hill

TRIBHUVAN UNIVERSITY

Faculty of Humanities & Social Sciences

OFFICE OF THE DEAN

TU QUESTIONS-ANSWERS 2019

Bachelor in Computer Applications — Full Marks: 60
Course Title: System Analysis & Design — Pass Marks: 24
Code No: CACS 203 — Time: 3 hours
Semester: III

Candidates are required to answer the questions in their own words as far as possible.

Group A

Attempt all the questions. **[10x1 = 10]**

1. Circle (O) the correct answer.

i) Which of the following Information systems are aimed at improving the routine business activities on which all organizations depend?
   a) Management Information systems
   b) Decision support systems
   c) Transaction Processing Systems
   d) Executive Information

ii) The project life cycle not consists of.....
   a) Understanding the scope of the project
   b) Objectives of the project
   c) Formulation and planning various activities
   d) Word Processor

iii) Which is the most important feature of spiral model?
   a) Quality Management b) Efficiency Management
   c) Risk Management d) Performance Management

iv) ..... includes the existing system, the proposed system, system flow charts, modular design of the system, print layout charts and data file designs.
   a) Feasibility Report b) Functional Specification Report
   c) Design Specification Report d) Terms of Reference

v) For the best Software model suitable for the project, in which of the phase the developers decide a roadmap for project plan?
   a) Software b) System Analysis
   c) Coding d) Testing

vi) Using the ..... approach, a new system is tested in one part of the organization before being implement in others.
   a) Direct b) Parallel
   c) Phased d) pilot

vii) ..... extends the software beyond its original functional requirements.
   a) Adaptive maintenance b) Perfective maintenance
   c) Corrective maintenance d) Perspective maintenance

viii) Which normal form looks at removing partial dependencies?
   a) First Normal Form b) Second Normal Form
   c) Third Normal Form d) Fourth Normal Form

ix) In constructing ER diagrams, double ovals are used to denote .....

a) Multi-value table
b) Multi-value entity
c) Multi-value attributes
d) Multi-value key

x) Testing beyond normal operational capacity is .....
a) Performance testing
b) Stress testing
c) Recovery testing
d) none of the above

Answer-Key

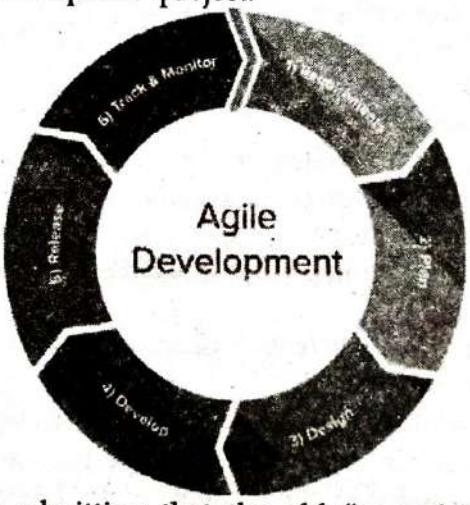
i. (c)	ii. (d)	iii. (c)	iv. (c)	v. (b)	vi. (d)	vii. (d)	viii. (d)	ix. (b)	x. (b)

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. When would you use agile methodologies? How is it different from waterfall approach to system development?

Ans: The Agile software development model was mainly intended for helping developers build a project which can adapt to transforming requests quickly. So, the most important endeavor for developing the agile model is to make easy and rapid project achievement. For attaining this task, developers need to preserve the agility during development. Agility can be achieved by correcting the progression to the project by eliminating activities which may not be crucial for that specific project.



It works by first admitting that the old "waterfall" method of software development leaves a lot to be desired. The process of "plan, design, build, test, deliver," works okay for making cars or buildings but not as well for creating software systems. In a business environment where hardware, demand, and competition are all swiftly-changing variables, agile works by walking the fine line between too much process and not enough.

It abandons the risk of spending months or years on a process that ultimately fails because of some small mistake in an early phase. It relies instead on trusting employees and teams to work directly with customers to understand the goals and provide solutions in a fast and incremental way.

- **Faster, smaller:** Traditional software development relied on phases like outlining the requirements, planning, design, building, testing, and delivery. Agile methodology, by contrast, looks to deploy the first increment in a couple weeks and the entire piece of software in a couple months.
- **Communication:** Agile teams within the business work together daily at every stage of the project through face-to-face meetings. This

collaboration and communication ensure the process stays on track even as conditions change.

- **Feedback:** Rather than waiting until the delivery phase to gauge success, teams leveraging agile methodology track the success and speed of the development process regularly. Velocity is measured after the delivery of each increment.
- **Trust:** Agile teams and employees are self-organizing. Rather than following a manifesto of rules from management intended to produce the desired result, they understand the goals and create their own path to reach them.
- **Adjust:** Participants tune and adjust the process continually, following the KIS or Keep It Simple principle.

Difference between Agile and Waterfall Model:

Agile	Waterfall
It separates the project development lifecycle into sprints.	Software development process is divided into distinct phases.
It follows an incremental approach	Waterfall methodology is a sequential design process.
Agile methodology is known for its flexibility.	Waterfall is a structured software development methodology so most times it can be quite rigid.
Agile can be considered as a collection of many different projects.	Software development will be completed as one single project.
Agile is quite a flexible method which allows changes to be made in the project development requirements even if the initial planning has been completed.	There is no scope of changing the requirements once the project development starts.
Agile methodology, follow an iterative development approach because of this planning, development, prototyping and other software development phases may appear more than once.	All the project development phases like designing, development, testing, etc. are completed once in the Waterfall model.
Test plan is reviewed after each sprint	The test plan is rarely discussed during the test phase.
Agile development is a process in which the requirements are expected to change and evolve.	The method is ideal for projects which have definite requirements and changes not at all expected.
In Agile methodology, testing is performed concurrently with software development.	In this methodology, the "Testing" phase comes after the "Build" phase
Agile introduces a product mindset where the software product satisfies needs of its end customers and changes itself as per the customer's demands.	This model shows a project mindset and places its focus completely on accomplishing the project.
Agile methodology works exceptionally well with Time & Materials or non-fixed funding. It may increase stress in fixed-price scenarios.	Reduces risk in the firm fixed price contracts by getting risk agreement at the beginning of the process.
Prefers small but dedicated teams with a high degree of coordination and synchronization.	Team coordination/synchronization is very limited.

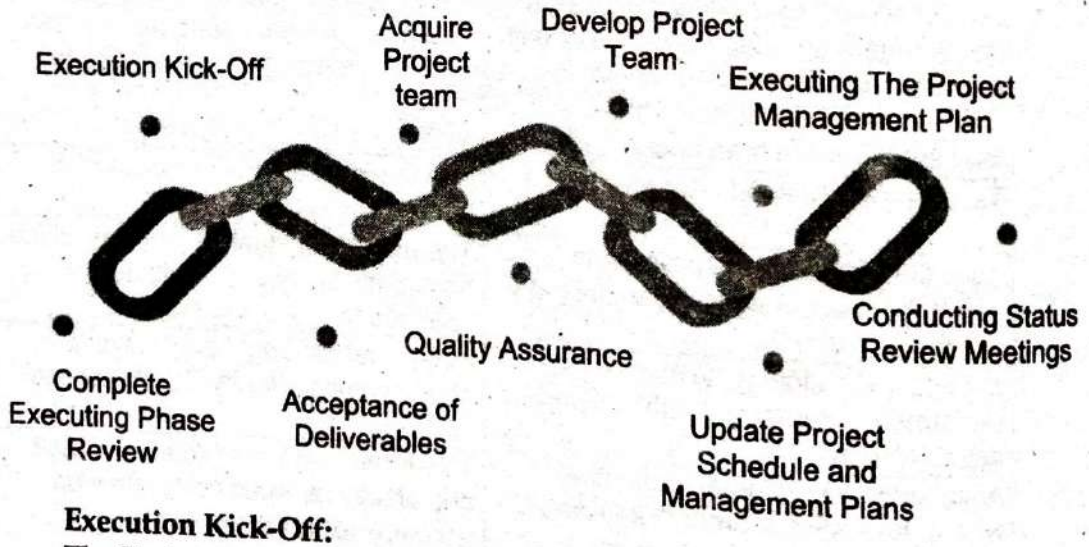
Products owner with team prepares requirements just about every day during a project.	Business analysis prepares requirements before the beginning of the project.
Test team can take part in the requirements change without problems.	It is difficult for the test to initiate any change in requirements.
Description of project details can be altered anytime during the SDLC process.	Detail description needs to implement waterfall software development approach.
The Agile Team members are inter-changeable; as a result, they work faster. There is also no need for project managers because the projects are managed by the entire team	In the waterfall method, the process is always straightforward so, project manager plays an essential role during every stage of SDLC.

3. Why is project management important? Briefly explain the activities performed by the project manager during project execution.

Ans: To put things into perspective, project management is essentially about delivering an output that will affect some change for the benefit of the organization. And, to know more why project management important is, below down is a list of some reasons that will give you a convincing explanation on its importance and relevance.

1. Clear focus and objectives
2. Realistic project planning
3. Maximum resource utilization
4. Risk management
5. Quality control

Project performance, on the surface, seems easy to measure; just track time, cost and scope and it's done. The activities performed by the project manager during project execution are listed below;



Execution Kick-Off:

The Project Manager can begin the phase activities following the completion of all planning activities including approval of the PMP, functional specifications & project funding.

Acquire Project team:

The project manager follows necessary steps to obtain the human resources needed to complete the project. Resource calendars are built and resource allocation for the project is done based on the negotiations and acquisitions with the involved business units and resource pool managers.

Develop Project Team:

The project manager evaluates each individual skill sets to ensure that the each team member has the proper skill sets for each upcoming project phase. Note: your training plan, schedule and costs come in handy as described in the planning phase.

Project leaders that can align their vision and work with their teams will successfully deliver key programs and projects. The alignment of vision and strategy to implementation will help you close those gaps.

Executing THE Project Management Plan:

The project manager executes the project management plan activities by performing the activities contained within each of the plans such as Communication Plan, Risk management plan, etc. The project manager will direct the various technical and organizational resources that exist in the project to execute the work defined in the project management plans.

Conducting Status Review Meetings (PSR):

Project status meetings help project managers in reviewing the status collected from the team members. They help the project managers in assessing what has been accomplished till date and compare them with the planned activities.

They allow project managers in the assessment of current problem areas and project risk areas; as well as communicating critical project information with quick feedback. Having these project status meetings also eliminates the communication problem that arises out of an assumption or belief that "everyone knows what's going on in this project". Often team members do not know, because they are busy with their own tasks.

Update Project Schedule and Management plans:

In most organizations, the project management team is the group of people responsible for updating the project plan. The project plan is many things to the project manager. It is a record of what has occurred on the project. It illustrates what is happening on the project right now. And, it prepares the project team by showing what will be coming up.

Quality Assurance:

In the Project Management Body of Knowledge (PMBOK), Quality Assurance is part of the Executing process group and is performed throughout the duration of the project. Quality Assurance is the process of auditing the quality requirements and the results from quality control measurements to ensure that appropriate quality standards and operational definitions are used. The key benefit of this process is that it facilitates the improvement of quality processes.

Acceptance of Deliverables:

Acceptance criteria for project deliverables establishes in advance an agreed upon standard of performance or capability that the user will accept in a specific deliverable The Performance Plan developed in the Project Planning Phase articulates the project deliverables and acceptance criteria. Acceptance criteria then become the fundamental guideline for the design team to build a solution that the user will find acceptable.

Complete Execution Phase Review:

The project manager contacts all participating stakeholders to review and document lessons learned in the execution phase. A formal Phase Review form is duly filled and sent to the Project Sponsor for approval.

It is basically to seek permission to proceed to the next phase and closure of the existing phase. All deliverables are reviewed, accepted & approved, any pending issues are documented along with their resolution plan and all relevant plans and documents are updated accordingly.

4. List various methods of interacting with a system. Briefly explain the factors to be considered while designing a form?

Ans: there are several methods of interaction between the human and the computer. These are defined below:

- Command language interaction
- Form interaction
- Menu interaction
- Natural language interaction
- Object based interaction

Form design in affected by some factors. These factors should be borne in mind while designing the forms.

1. **Suitable for the Purpose:** Easy clerical operation is the main purpose of designing an office form. At the same time, if a blank sheet of paper is enough to serve the purpose, there is no need of preparing or designing any printed form. Therefore, form should be designed in such a way that they are suitable for the purpose for which they are meant.
2. **Ease in Use:** The forms should be designed that they are easy to use. If a form is filled up with the help of a typewriter, adequate space is provided according to the typewriter. Likewise, a form is filled up with the help of accounting machine or computer; forms have to be designed accordingly. Besides, spacing between lines is also properly provided.
3. **Simple Design:** Simple form facilitates the user in use and requires less time in completion. Simple design means providing clear column, headings, concise and clear instruction for use and adequate space for numbering. Besides, frequently required information should be placed in such a position on the form, which can be readily accessible by the reader.
4. **Size of the Form:** The size of the form depends upon the purpose for which the forms are meant. The office manager should consider the following points while deciding size of the form.
   - Size of the column permits entries to be made
   - Description of data or information is entered at the top of the form and the space needed for it.
5. **Title of Form and Number:** The title of the form and number should be printed at the top of the form. The title should be short and simple. Both title and number help the storekeeper to store the forms properly.
6. **Proper Printing:** Forms must be printed properly. The style of letters, size of letters and the type of printing are based on the purpose of the form. The style and size of letters are in such a way that can be readable very easily. Besides, the office manager with regard to a neat and pleasing look of the office forms must take proper care

7. **Use of Paper:** The proper type of paper is used for printing the forms. The method of handling appearance desired, duration of keeping the forms and the impression designed (of writing, typing or printing) are the determinants of type of paper utilization.
8. **Ease in Punching, Scoring and Perforation:** It is very important to consider that the forms should allow the operations of punching, scoring and perforation very easily. Hence, it is necessary that the exact specification should be considered while designing them. A hand punch may be used in the office if a punching is required. Scoring facilitates the folding of paper and Perforation helps to detach them from the forms book after they are filled up.

5. What are the deliverables from coding and testing? Briefly explain the different approaches to installation.

Ans: deliverables are basically the output or the result of a process or an activity within a project. In coding phase, the most important deliverable is the code itself and also the documentation of the code. Program documentation is very important for maintenance of the system as it provides all the details of the data, logic, variables, function calls etc.

6. Why is normalization required? State second normal form and explain it with a proper example.

Ans: Normalization is a database design technique which organizes tables in a manner that reduces redundancy and dependency of data. It divides larger tables to smaller tables and links them using relationships.

Normalization is the process of removing redundant data from your tables in order to improve storage efficiency, data integrity and scalability. This improvement is balanced against an increase in complexity and potential performance losses from the joining of the normalized tables at query-time. There are two goals of the normalization process: eliminating redundant data (for example, storing the same data in more than one table) and ensuring data dependencies make sense (only storing related data in a table). Both of these are worthy goals as they reduce the amount of space a database consumes and ensure that data is logically stored.

We normalize the relational database management system because of the following reasons:

- **Minimize data redundancy** i.e. no unnecessarily duplication of data.
- **To make database structure flexible** i.e. it should be possible to add new data values and rows without reorganizing the database structure.
- **Data should be consistent throughout the database** i.e. it should not suffer from following anomalies.
- **Insert Anomaly** - Due to lack of data i.e., all the data available for insertion such that null values in keys should be avoided. This kind of anomaly can seriously damage a database
- **Update Anomaly** - It is due to data redundancy i.e. multiple occurrences of same values in a column. This can lead to inefficiency.
- **Deletion Anomaly** - It leads to loss of data for rows that are not stored elsewhere. It could result in loss of vital data.
- Complex queries required by the user should be easy to handle.

Second Normal Form (2nd NF)

In 2nd NF:

- Remove Partial Dependencies.
- Functional Dependency: The value of one attribute in a table is determined entirely by the value of another.
- Partial Dependency: A type of functional dependency where an attribute is functionally dependent on only part of the primary key (primary key must be a composite key).
- Create separate table with the functionally dependent data and the part of the key on which it depends. Tables created at this step will usually contain descriptions of resources.

Definition: A relation is in 2NF if it is in 1NF and every non-key attribute is fully dependent on each candidate key of the relation.

Example

The following relation is not in Second Normal Form:

Order	Customer	Contact Person	Total
1	Rishabh	Manish	134.23
2	Preeti	Rohan	521.24
3	Rishabh	Manish	1042.42
4	Rishabh	Manish	928.53

In the table above, the order number serves as the primary key. Notice that the customer and total amount are dependent upon the order number – this data is specific to each order. However, the contact person is dependent upon the customer. An alternative way to accomplish this would be to create two tables:

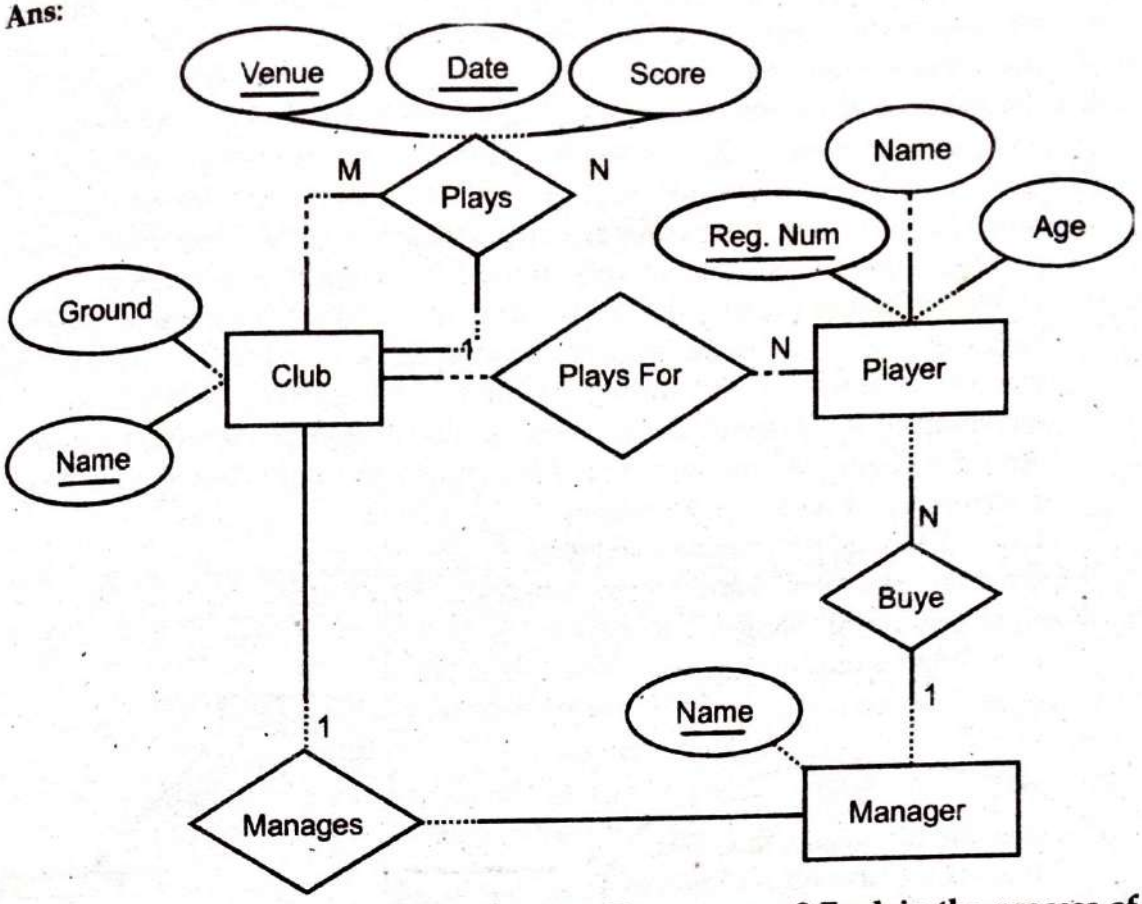
Order	Customer	Total
1	Rishabh	134.23
2	Preeti	521.24
3	Rishabh	1042.42
4	Rishabh	928.53

Customer	Contact Person
Rishabh	Manish
Preeti	Rohan

The creation of two separate tables eliminates the dependency problem. In the second table, contact person is dependent upon the primary key – customer name. The first table only includes the information unique to each order. Someone interested in the contact person for each order could obtain this information by performing a Join Operation.

7. **Construct an E-R Diagram for football club that has a name and a ground and is made up for players. A player can play for only one club and a manager identified by his name manage a club. A footballer has a registration number, name and age. A club manager also buys players. Each club plays against other clubs in the league and matches have a date, venue and score.**

Ans:



8. Maintenance is an on-going process. Do you agree? Explain the process of maintaining information systems.

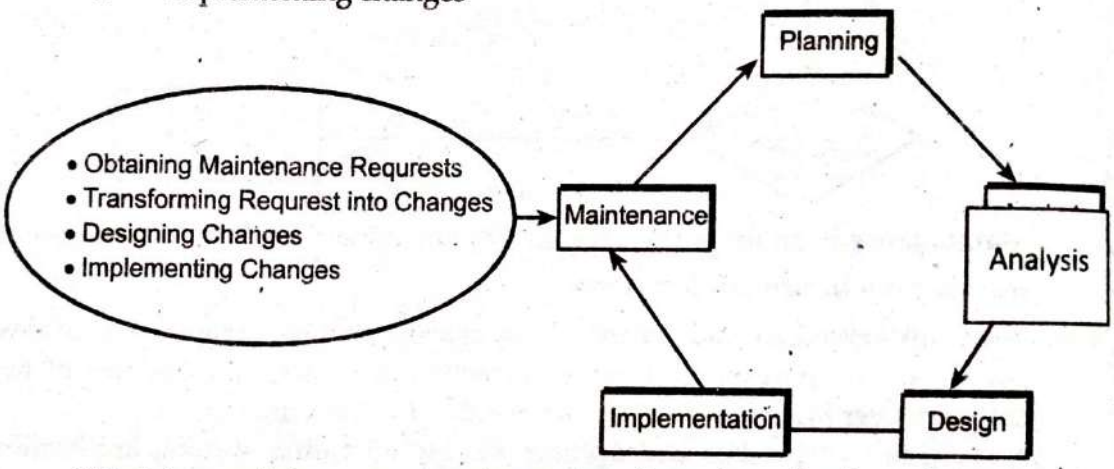
Ans: Yes I am agreed to maintenance is on-goring process because it includes: continuing support for end users, correction of errors, and updates of the software over time. It is ongoing process due to following reasons:

- Install all patches and updates for the operating system, application (including interfaces), and security software.
- Review information system activity, including system utilization, capacity, and response time.
- Replace servers, client devices, and network devices on a routine schedule.
- Provide for system administration services 24/7.
- Maintain network schematics, application inventories, and network inventories, potentially using automated tools to detect rogue devices or applications.
- Ensure network, server, and device redundancy with failure and fault tolerance capability.
- Maintain and test contingency plans for routine backup and restoration, business continuity, and disaster recovery—including manual contingency plans to be performed by end users if necessary.
- Utilize Internet and email usage/monitoring tools, firewalls, intrusion detection, and anti-malware tools.
- Secure all servers and network devices in an applicable data center environment.
- Ensure system administration passwords are especially strong and protected.

Organizations need to establish filing systems to accommodate the different types of records they need to keep. These files must be updated regularly and accurate to maintain the integrity of the files. A business might establish a centralized filing system where all their records are kept it one area or non-centralized systems which are seen in departments within organizations who have control of their own records. These files can be paper-based (stored in cabinets), electronic (computer systems), stored in fixed filing areas or in a portable filing system (can be easily moved from one area to another).

The maintenance phase is the last phase of the SDLC. It is here that the SDLC becomes a cycle, with the last activity leading back to the first. This means that the process of maintaining an information system is the process of returning to the beginning of the SDLC and repeating development steps until the change is implemented. Also shown in Figure below, four major activities occur within maintenance:

1. Obtaining maintenance requests
2. Transforming requests into changes
3. Designing changes
4. Implementing changes



Obtaining maintenance requests requires that a formal process be established whereby users can submit system change requests. Most companies have some sort of document like an SSR to request new development, to report problems, or to request new features within an existing system. When developing the procedures for obtaining maintenance requests, organizations must also specify an individual within the organization to collect these requests and manage their dispersal to maintenance personnel.

Once a request is received, analysis must be conducted to gain an understanding of the scope of the request. It must be determined how the request will affect the current system and how long such a project will take. As with the initial development of a system, the size of a maintenance request can be analyzed for risk and feasibility. Next, a change request can be transformed into a formal design change, which can then be fed into the maintenance implementation phase.

Thus, many similarities exist between the SDLC and the activities within the maintenance process. The first phase of the SDLC – planning – is analogous to the maintenance process of obtaining a maintenance request (step 1). The SDLC analysis phase is analogous to the maintenance process of

transforming requests into a specific system change (step 2). The SDLC design phase, of course, equates to the designing changes process (step 3). Finally, the SDLC phase implementation equates to step 4, implementing changes. This similarity between the maintenance process and the SDLC is no accident. The concepts and techniques used to initially develop a system are also used to maintain it.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. Develop a context diagram and top level logical DFD for the system made up of the following.

- B & B is a mail-order company that distributes CDs, DVDs of music, games, movies, software at discount prices to club members.
- When an order processing clerk receives an order form, he or she verifies that the sender is a club member by checking the Member file.
- If the sender is not a member, the clerk returns the order along with a membership application form.
- If the customer is a member, the clerk verifies the order item data by checking the item file.
- Then the clerk enters the order data and saves it to the Daily Order file. The clerk also prints and invoice and shipping list for each order, which are forwarded to Order Fulfillment Department.

Ans: Mail Ordering System: Context Diagram

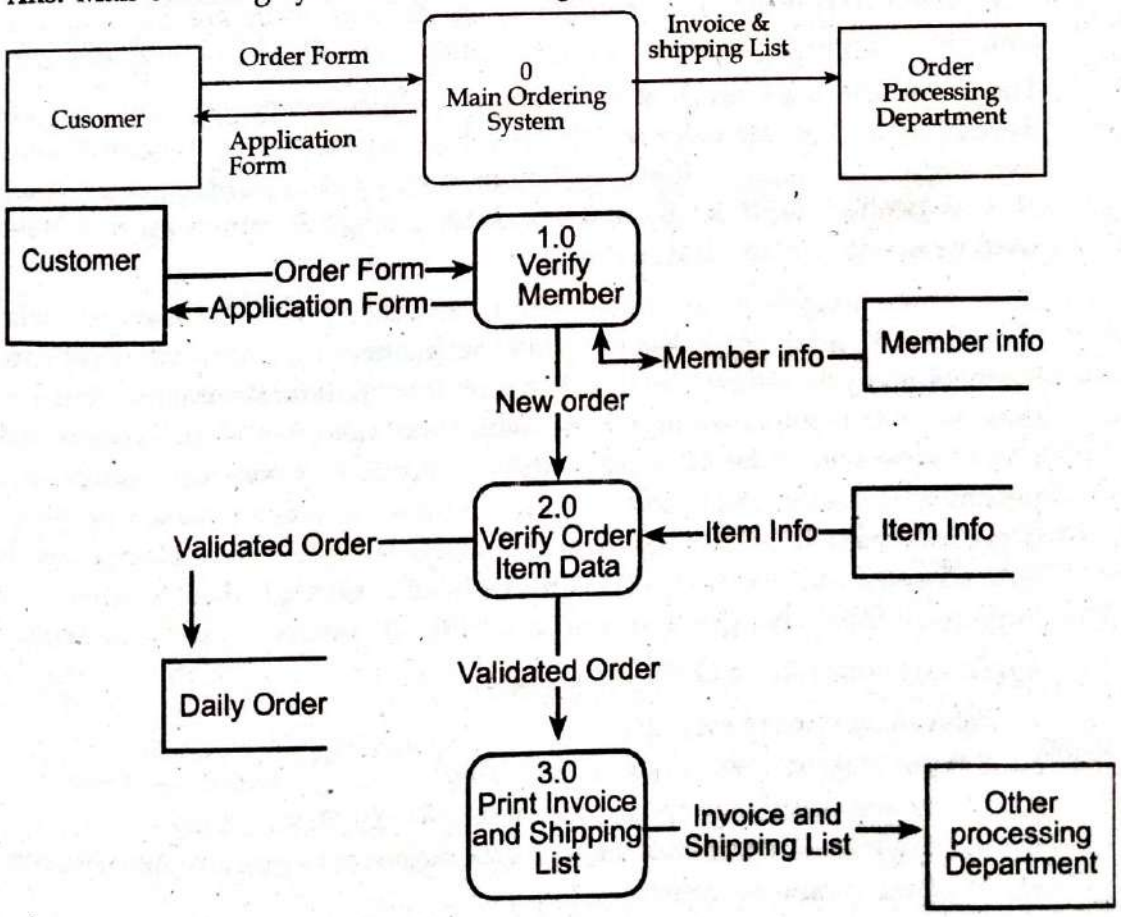


Figure: Mail ordering system level 0 diagram

10. With proper reasoning, explain how CASE Tools aid in information system development? You have been hired as a system analyst in TU tech software Development Company and you are asked to analyze the way system works. What qualities do you need to have to analyze such type of systems?

Ans: Computer Aided Software Engineering i.e. CASE is the methodical application of a set of tools and techniques to a candidate system to meet the goal of achieving a superior product in terms of quality, validity, testability and maintainability with the optimum utilization of cost time and other relevant resources.

The era of CASE tools began in the late seventies. With time, in early nineties, an effective and high tech era evolved with a great inclination towards the CASE tools utilization. Computer Aided Software engineering tools plays a vital role in a software development process. The main aim of introducing and implementing the CASE tools in the development process is to enhance the qualitative aspects of the target product. CASE tools are basically a class of software that helps in the automation of the various activities associated with the development procedure.

The role of CASE tools is not limited to a particular phase of development; instead they provide support to almost all the phases of software development. CASE tools on the basis of their support to the types of activities in the development process, can be classified as, Knowledge-based CASE dimension, Life-cycle support, Construction dimension and Integration dimension, Few commonly used CASE tools are ER diagrams, Data flow diagram, Decision tables, Smalltalk, Process Weaver and Rational.

Though CASE tools are best to use for an effective and efficient software development, but few risks and drawbacks like inadequate standardization, unrealistic expectations, slow implementation, weak repository controls are also associated with it. By time and technological enhancements these weaknesses would also be removed.

A systems analyst is an information technology (IT) professional who specializes in analyzing, designing and implementing information systems. Systems analysts assess the suitability of information systems in terms of their intended outcomes and liaise with end users, software vendors and programmers in order to achieve these outcomes. A systems analyst is a person who uses analysis and design techniques to solve business problems using information technology. Systems analysts may serve as change agents who identify the organizational improvements needed, design systems to implement those changes, and train and motivate others to use the systems.

Typical responsibilities of the job include:

- examining current systems
- talking to users (requirements gathering)
- producing specifications for new or modified systems
- liaising with other IT staff such as programmers to produce new systems
- implementing new systems

They are also responsible for user training and feedback. Travel is a key feature of the job as the majority of work is undertaken at clients' premises.

11. (a) Why software project often fails? Explain different types of software testing?

Ans: The possibility of software projects failing can be attributed to various reasons-costs, scheduling and quality issues, and/or achievement of objectives. This pose a serious threat to companies wishing to outsource their software development needs, as software project management failures often cause huge losses in time and money, and can prove to be detrimental to a company's growth and development. Some major reasons of software project fails are listed below:

- Poor Preparation
- Inadequate Documentation and Tracking
- Bad Leadership
- Failure to Define Parameters and Enforce Them
- Inexperienced Project Managers
- Inaccurate Cost Estimations
- Little Communication at Every Level of Management
- Culture or Ethical Misalignment
- Competing Priorities
- Disregarding Project Warning Signs

Different types of software testing

Testing is a process of executing a program with the aim of finding error. To make our software perform well it should be error free. If testing is done successfully it will remove all the errors from the software. Software testing is generally classified into two main broad categories: functional testing and non-functional testing. There is also another general type of testing called maintenance testing.

1. **Functional Testing**

   Functional testing involves the testing of the functional aspects of a software application. When you're performing functional tests, you have to test each and every functionality. You need to see whether you're getting the desired results or not. There are several types of functional testing, such as:

   Unit testing, Integration testing, End-to-end testing, Smoke testing, Sanity testing, Regression testing, Acceptance testing, White box testing, Black box testing, Interface testing etc.

   Functional tests are performed both manually and using automation tools. For this kind of testing, manual testing is easy, but you should use tools when necessary. Some tools that you can use for functional testing are Micro Focus UFT (previously known as QTP, and UFT stands for Unified Functional Testing), Selenium, JUnit, soapUI, Watir, etc.

2. **Non-functional Testing**

   Non-functional testing is the testing of non-functional aspects of an application, such as performance, reliability, usability, security, and so on. Non-functional tests are performed after the functional tests. With non-functional testing, you can improve your software's quality to a great extent. Functional tests also improve the quality, but with non-functional tests, you have the opportunity to make your software even better. Non-functional testing allows you to polish the software. This

kind of testing is not about whether the software works or not. Rather, it's about how well the software runs, and many other things. Non-functional tests are not generally run manually. In fact, it's difficult to perform this kind of tests manually. So these tests are usually executed using tools. There are several types of non-functional testing, such as: Performance testing, Security testing, Load testing, Failover testing, Compatibility testing, Usability testing, Scalability testing, Volume testing, Stress testing, Maintainability testing, Compliance testing, Efficiency testing, Reliability testing, Endurance testing, Disaster recovery testing, Localization testing, Internationalization testing etc.

1. **Unit Testing**
   Testing each component or module of your software project is known as unit testing. To perform this kind of testing, knowledge of programming is necessary. So only programmers do this kind of tests, not testers. You have to do a great deal of unit testing as you should test each and every unit of code in your project.
2. **Integration testing**
   After integrating the modules, you need to see if the combined modules work together or not. This type of testing is known as integration testing. You need to perform fewer integration tests than unit tests. Some good tools for unit and integration testing are Jasmine, Mocha, etc.
3. **End-to-end Testing**
   End-to-end testing is the functional testing of the entire software system. When you test the complete software system, such testing is called end-to-end testing. You need to perform fewer end-to-end tests than integration tests. Cucumber, Protractor, Jasmine, Karma, etc. are some great end-to-end testing tools.
4. **User Interface Testing**
   User interface testing involves the testing of the application's user interface. The aim of UI tests is to check whether the user interfaces have been developed according to what is described in the requirements specifications document.
5. **Accessibility testing**
   Testing whether your software is accessible to disabled people or not is termed as accessible testing. For this type of tests, you need to check if disabled people such as those who are color blind, blind, and deaf can use your application.
6. **Alpha testing**
   Alpha testing is a kind of testing to look for all the errors and issues in the entire software. This kind of test is done at the last phase of app development and is performed at the place of the developers, before launching the product or before delivering it to the client to ensure that the user/client gets an error-free software application. Alpha testing is run before the beta testing, which means that after performing alpha testing, you need to run beta testing.
7. **Beta testing**
   As said earlier, beta testing takes place after alpha testing. Beta testing is done before the launch of the product. It is carried out in a real user environment by a limited number of actual customers or users, in order

to be certain that the software is completely error-free and it functions smoothly. After collecting feedback and constructive criticism from those users, some changes are made to make the software better.

8. **Ad-hoc testing**

As the name suggests, ad-hoc testing is a kind of testing that is performed in an ad-hoc manner, without using any test cases, plans, documentation, or systems. Unlike all other types of testing, this kind of testing is not carried out in a systematic manner.

Although finding errors can be difficult without using test cases, there are technical issues that are easily detected through an ad-hoc test, but are hard to find through other testing approaches that use test cases.

9. **Compatibility testing**

Compatibility testing involves compatibility checking of the software with different operating systems, web browsers, network environments, hardware, and so on. It checks whether the developed software application is working fine with different configurations.

10. **Backward compatibility testing**

Backward compatibility testing is carried out to test if a brand new or an updated version of an application is compatible with the previous versions of the environments (such as operating systems and web browsers) on which the software runs. Sometimes, some application is updated specifically to match the standard and style of a newer, more modern environment. In that case, support for backward compatibility is necessary.

11. **Browser compatibility testing**

As the name says, browser compatibility testing checks a web application for browser compatibility. More specifically, it is tested whether the web app can easily be accessed from all versions of the major web browsers.

12. **Performance testing**

Performance tests are run to check if the software's performance is good or not. There are performance testing tools that analyze your app's performance and show you the performance issues. By fixing those issues, you'll be able to increase the performance of your software application.

13. **Load testing**

Load testing is one kind of performance testing that tests how much load a system can take before the software performance begins to degrade. By running load tests, we can know the capacity of taking load of a system.

14. **Recovery testing**

Recovery testing involves the checking of whether the application can recover from crashes and how well it recovers. In this kind of tests, testers observe how well the software can come back to the normal flow of execution. Crashes can happen anytime. Even if your software is of exceptional quality, crashes may happen. You don't know when they may take place and annoy the users.

15. **Regression testing**
If you need to make changes in any component, module, or function, you have to see if the whole system functions properly after those modifications. Testing of the whole system after such modifications is known as regression testing.

16. **API testing**
Just like unit testing, API testing is also a code-level testing type. The basic difference between unit testing and API testing is that unit testing is performed by the development team whereas API testing is handled by the QA team.

17. **Black box testing**
Performed by the QA team of a company, black box testing is a testing technique that involves the checking of the application's functionality without having any technical knowledge of the application, like the knowledge of the code's logic, how the code works, knowledge of the internal structure, etc.

18. **White box testing**
Performed by the development team, white box testing is a testing method that requires a good understanding of the application's code. It requires great knowledge of the app's internal logic.

19. **Security testing**
Security tests are performed to ensure the security of your application, in order that security breaches can be prevented. Security experts run this kind of tests to see how much your software is secure from attacks and to find security issues so that the app's security can be strengthened.

20. **Usability testing**
Testing the user-friendliness of an app is known as usability testing. It involves the checking of how much usable or user-friendly the app is. It is tested whether any user can easily use your software without getting stuck.
One of the best ways to test the usability of your software is to invite a few people to use your software. See if they can do certain things in your app without taking any help from you.

21. **Scalability testing**
Scalability testing verifies whether the software is scalable or not. In other words, it checks if your app performs well when the number of users, amount of data, or the number of transactions increases significantly. A software application that is not scalable may cause great business loss.

22. **Reliability testing**
Reliability testing is a type of software testing that verifies if the software is reliable or not. In other words, it checks whether the software runs error-free and that one can rely on it.

23. **Acceptance testing**
The client who will purchase your software will perform acceptance testing (also known as User Acceptance Testing) to see if the software can be accepted or not by checking whether your software meets all the client's requirements and preferences. If your software doesn't meet all the requirements or if your client doesn't like something in the app, they may request you to make changes before accepting the project.

10. (b) List of OOAD. Differentiate between structured methodologies and object oriented methodologies.

Ans: Major Elements: By major, it is meant that if a model does not have any one of these elements, it ceases to be object oriented. The four major elements are:

- Abstraction
- Encapsulation
- Modularity
- Hierarchy

Structured methods are useful for modeling processes, but do not handle the modeling of data well. They also treat data and processes as logically separate entities, whereas in the real world such separation seems unnatural. Different modeling conventions are used for analysis (the data flow diagram) and for design the structure chart). Object-oriented development addresses these issues.

The main difference between structured and object oriented programming is that structured programming allows developing a program using a set of modules or functions, while object oriented programming allows constructing a program using a set of objects and their interactions. Differentiate between structured methodologies and object oriented methodologies are tabulated below:

Structured Programming	Object Oriented Programming
Structured Programming is designed which focuses on process/ logical structure and then data required for that process.	Object Oriented Programming is designed which focuses on data.
Structured programming follows top-down approach.	Object oriented programming follows bottom-up approach.
Structured Programming is also known as Modular Programming and a subset of procedural programming language.	Object Oriented Programming supports inheritance, encapsulation, abstraction, polymorphism, etc.
In Structured Programming, Programs are divided into small self-contained functions.	In Object Oriented Programming, Programs are divided into small entities called objects.
Structured Programming is less secure as there is no way of data hiding.	Object Oriented Programming is more secure as having data hiding feature.
Structured Programming can solve moderately complex programs.	Object Oriented Programming can solve any complex programs.

TRIBHUVAN UNIVERSITY

Faculty of Humanities & Social Sciences

OFFICE OF THE DEAN

TU QUESTIONS-ANSWERS 2020

Bachelor in Computer Applications
Course Title: System Analysis & Design
Code No: CACS 203
Semester: III

Full Marks: 60
Pass Marks: 24
Time: 3 hours

Candidates are required to answer the questions in their own words as far as possible.

Group A

Attempt all the questions. [10x1 = 10]

1. Circle (O) the correct answer.

i. Which of the following information systems are aimed at improving the routine business activities on which all organization depend?

a) Management information system b) Decision support system
c) Transaction processing system d) Management support system

ii. Which of the following is a true statement regarding data flows?

a) A data flow may have multiple directions between symbols
b) A data flow to a data store means retrieve or use
c) A data flow from a data store means update
d) A join a data flow means that exactly the same data comes from any of two or more different processes, data stores or sources/sinks to common locations.

iii. Actual programming of software code is done during the .....step in the SDLC.

a) Maintenance and Evaluation b) Design
c) Analysis d) Development and Documentation

iv. Potential development projects cab be identitied by.....

a) Steering committee b) Top management
c) Senior IS manager d) All of the above

v. A cost associated with an information system that cannot be easily measured I terms of dollars or with certainty refers to.....

a) economic cost b) Tangible cost
c) Intangible cost d) One-time cost

vi. The impertinence characteristic of a good system analysist is represented by which of the following statements?

a) You must challenge yourself to look at the organization in new ways.
b) Every fact must fit with every other fact.
c) Assume anything is possible and eliminate the infeasible
d) You should question everything

vii. An E-R model with attributes is prepared during.....

a) Design b) Project identitication and selection
c) Analysis d) Project initiation and planning

viii. Documentation is prepared.....

a) At every stage
b) At system desing
c) At system analysis
d) At system development

ix. Sequential organization.....

a) Means storing records in contiguous blocks according to a key
b) Stores records sequentially but uses an index to locate records.
c) Uses an index for each key type
d) Has records placed randomly throughout the file

x. Acceptance tesing is.....

a) Running the system with linedata by the actual user
b) Making sure that the new programs do in fact process certain transaction according to specification
c) Is checking the logic of one or more programs in the candidate system
d) Testing changes made in an existing or a new program

Answer-Key

i. (c)	ii. (d)	iii. (d)	iv. (b)	v. (c)	vi. (c)	vii. (a)	viii. (a)	ix. (b)	x. (a)

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. What is system? What are the phases of SDLC? Explain briefly. [1+4]

Ans: A system is a collection of components (i.e. subsystems) that work together to realize some objective. For example, the **library system** contains **librarians, books,** and **periodicals** as components to provide knowledge for its members.

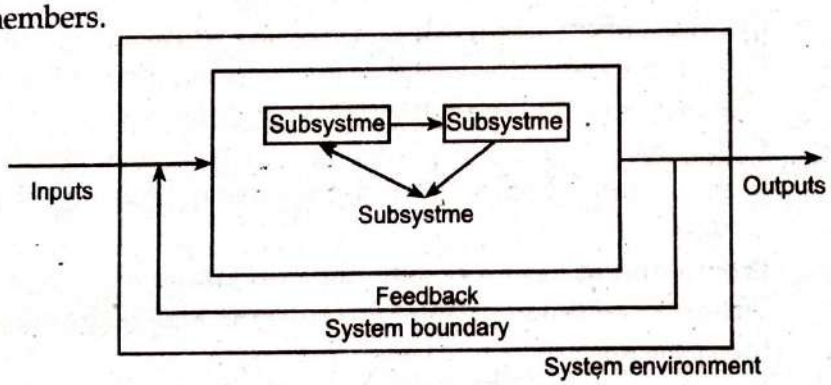
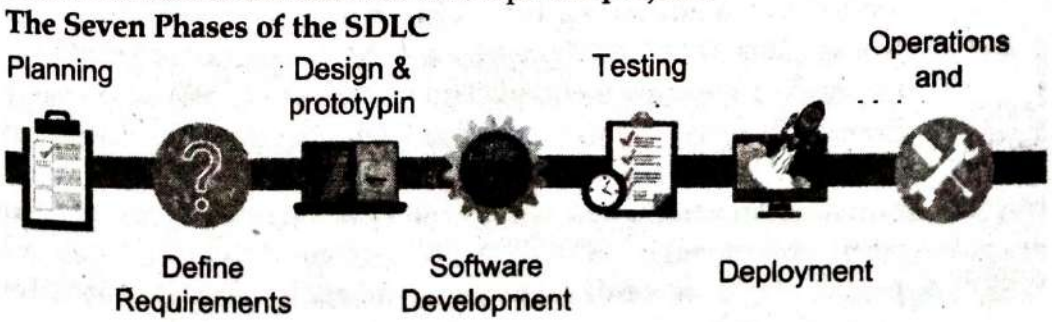


Fig: Basic System Model

SDLC

Software Development Life Cycle is the application of standard business practices to building software applications. It's typically divided into six to eight steps: Planning, Requirements, Design, Build, Document, Test, Deploy, maintain. Some project managers will combine, split, or omit steps, depending on the project's scope. These are the core components recommended for all software development projects.

The Seven Phases of the SDLC



1. **Planning:** In the Planning phase, project leaders evaluate the terms of the project. This includes calculating labor and material costs, creating a timetable with target goals, and creating the project's teams and leadership structure.

   Planning can also include feedback from stakeholders. Stakeholders are anyone who stands to benefit from the application. Try to get feedback from potential customers, developers, subject matter experts, and sales reps.

   Planning should clearly define the scope and purpose of the application. It plots the course and provisions the team to effectively create the software. It also sets boundaries to help keep the project from expanding or shifting from its original purpose.

2. **Define Requirements:** Defining requirements is considered part of planning to determine what the application is supposed to do and its requirements. For example, a social media application would require the ability to connect with a friend. An inventory program might require a search feature.

   Requirements also include defining the resources needed to build the project. For example, a team might develop software to control a custom manufacturing machine. The machine is a requirement in the process.

3. **Design and Prototyping:** The Design phase models the way a software application will work. Some aspects of the design include:
   - **Architecture** – Specifies programming language, industry practices, overall design, and use of any templates or boilerplate
   - **User Interface** – Defines the ways customers interact with the software, and how the software responds to input
   - **Platforms** – Defines the platforms on which the software will run, such as Apple, Android, Windows version, Linux, or even gaming consoles
   - **Programming** – Not just the programming language, but including methods of solving problems and performing tasks in the application
   - **Communications** – Defines the methods that the application can communicate with other assets, such as a central server or other instances of the application
   - **Security** – Defines the measures taken to secure the application, and may include SSL traffic encryption, password protection, and secure storage of user credentials

   Prototyping can be a part of the Design phase. A prototype is like one of the early versions of software in the Iterative software development model. It demonstrates a basic idea of how the application looks and works. This "hands-on" design can be shown to stakeholders. Use feedback o improve the application. It's less expensive to change the Prototype phase than to rewrite code to make a change in the Development phase.

4. **Software Development:** This is the actual writing of the program. A small project might be written by a single developer, while a large project might be broken up and worked by several teams. Use an

Access Control or Source Code Management application in this phase. These systems help developers track changes to the code. They also help ensure compatibility between different team projects and to make sure target goals are being met.

The coding process includes many other tasks. Many developers need to brush up on skills or work as a team. Finding and fixing errors and glitches is critical. Tasks often hold up the development process, such as waiting for test results or compiling code so an application can run. SDLC can anticipate these delays so that developers can be tasked with other duties.

Software developers appreciate instructions and explanations. Documentation can be a formal process, including wiring a user guide for the application. It can also be informal, like comments in the source code that explain why a developer used a certain procedure. Even companies that strive to create software that's easy and intuitive benefit from the documentation.

5. **Testing:** It's critical to test an application before making it available to users. Much of the testing can be automated, like security testing. Other testing can only be done in a specific environment – consider creating a simulated production environment for complex deployments. Testing should ensure that each function works correctly. Different parts of the application should also be tested to work seamlessly together – performance test, to reduce any hangs or lags in processing. The testing phase helps reduce the number of bugs and glitches that users encounter. This leads to a higher user satisfaction and a better usage rate.
6. **Deployment:** In the deployment phase, the application is made available to users. Many companies prefer to automate the deployment phase. This can be as simple as a payment portal and download link on the company website. It could also be downloading an application on a smartphone.

   Deployment can also be complex. Upgrading a company-wide database to a newly-developed application is one example. Because there are several other systems used by the database, integrating the upgrade can take more time and effort.
7. **Operations and Maintenance:** At this point, the development cycle is almost finished. The application is done and being used in the field. The Operation and Maintenance phase is still important, though. In this phase, users discover bugs that weren't found during testing. These errors need to be resolved, which can spawn new development cycles.

3. What do you mean by planning? Write the process of planning for Information System Development Project. [1+4]

Ans: A software development plan refers to the process of organized management for a project. It describes the activities and the resources needed to complete it successfully.

Software development planning encompasses the timeline of a development project. The plan describes all the phases of the process – analysis and planning, ideation, design and development, deployment, production and launch, and maintenance.

Project identification and selection consists of three primary activities as illustrated below:

- Identifying potential development projects
- Classifying and ranking projects
- Selecting projects for development

Each of these activities is described below.

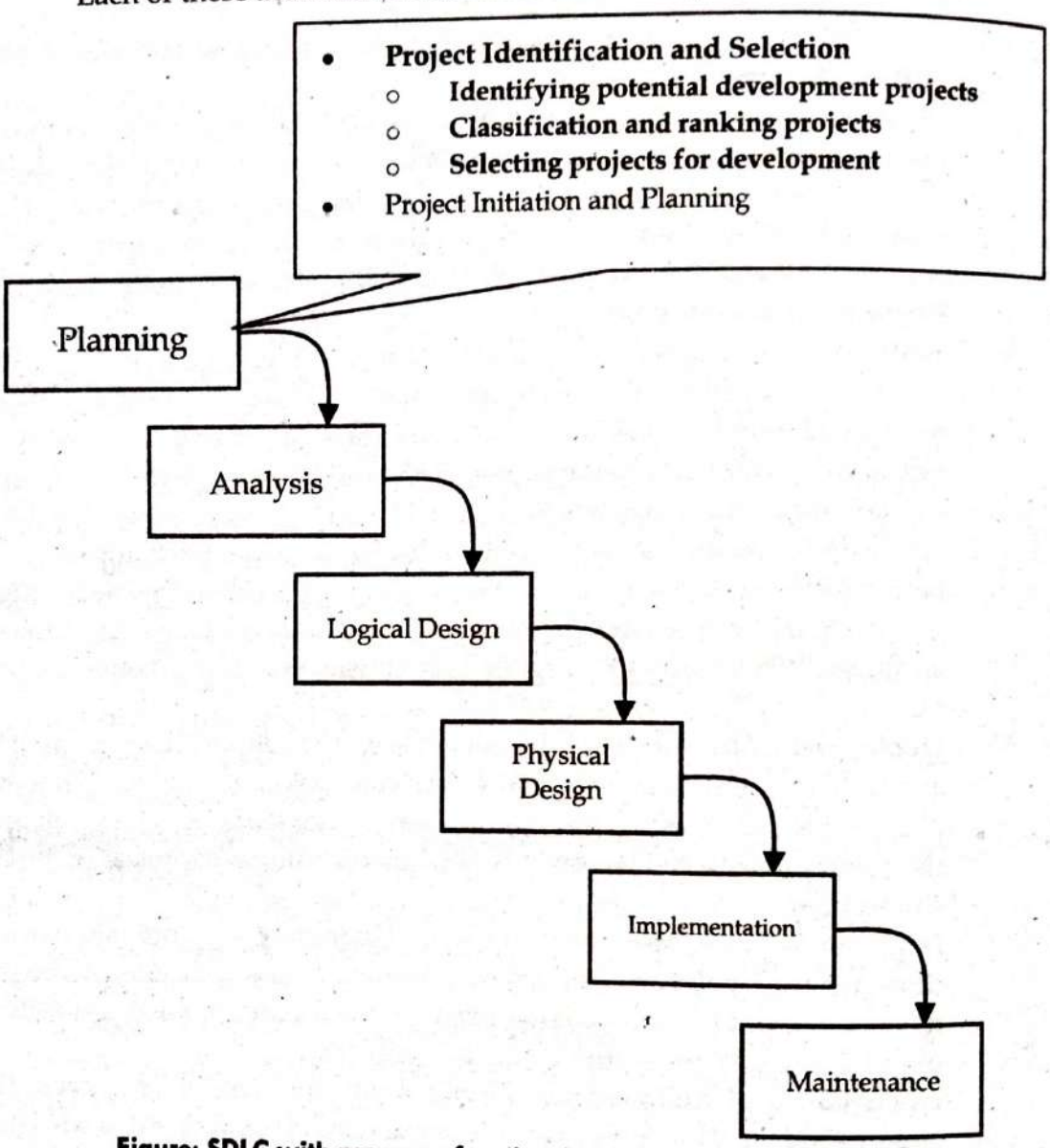


Figure: SDLC with process of project identification and selection highlighted

1. **Identifying Potential Development Projects**

Organizations vary as to how they identify projects.

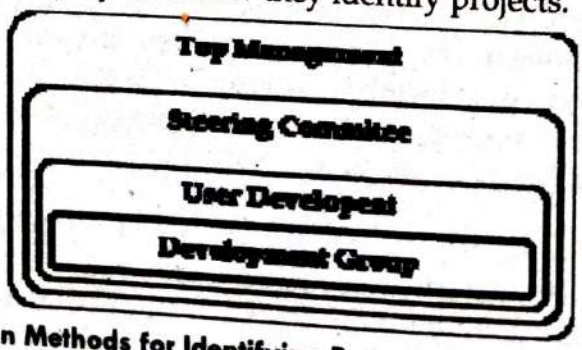


Fig: Selection Methods for Identifying Potential Development Projects

tputs

This process can be performed by:

- A key member of top management, either the CEO of a small or medium-size organization or a senior executive in a larger organization
- A steering committee, composed of a cross section of managers with an interest in systems
- User departments, in which either the head of the requesting unit or a committee from the requesting department decides which projects to submit (as a systems analyst, you will help users prepare such requests)
- The development group or a senior IS manager

Each identification method has strengths and weaknesses. For example, projects identified by top management have a strategic organizational focus. Alternatively, projects identified by steering committees reflect the diversity of the committee and therefore have a cross-functional focus. Projects identified by individual departments or business units have a narrow, tactical focus. The development group identifies projects based on the ease with which existing hardware and systems will integrate with the proposed project.

2. **Classifying and Ranking Projects**

   Assessing the merit of potential projects is the second major activity in the project identification and selection phase. As with project identification, classifying and ranking projects can be performed by top managers, a steering committee, business units, or the IS development group. The criteria used to assign the merit of a given project can vary based on the size of the organization.

   As with project identification, the criteria used to evaluate projects will vary by organization. If, for example, an organization uses a steering committee, it may choose to meet monthly or quarterly to review projects and use a wide variety of evaluation criteria. At these meetings, new project requests are reviewed relative to projects already identified, and ongoing projects are monitored. The relative ratings of projects are used to guide the final activity of this identification process—project selection.

   An important project evaluation method that is widely used for assessing information systems development projects is called **value chain analysis.** Value chain analysis is the process of analyzing an organization's activities for making products and/or services to determine where value is added and costs are incurred. Once an organization gains a clear understanding of its value chain, improvements in the organization's operations and performance can be achieved.

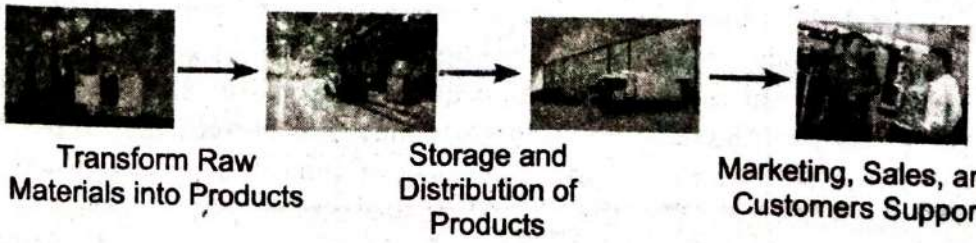


Figure: Organizations can be thought of as a value chain, transforming raw materials into products for customers

3. **Selecting IS Development Projects.**
The selection of projects is the final activity in the project identification and selection phase. The short- and long-term projects most likely to achieve business objectives are considered. As business conditions change over time, the relative importance of any single project may substantially change. Thus, the identification and selection of projects is an important and ongoing activity.
Numerous factors must be considered when selecting a project, as illustrated in figure below. These factors include:
- Perceived needs of the organization
- Existing systems and ongoing projects
- Resource availability
- Evaluation criteria
- Current business conditions
- Perspectives of the decision makers

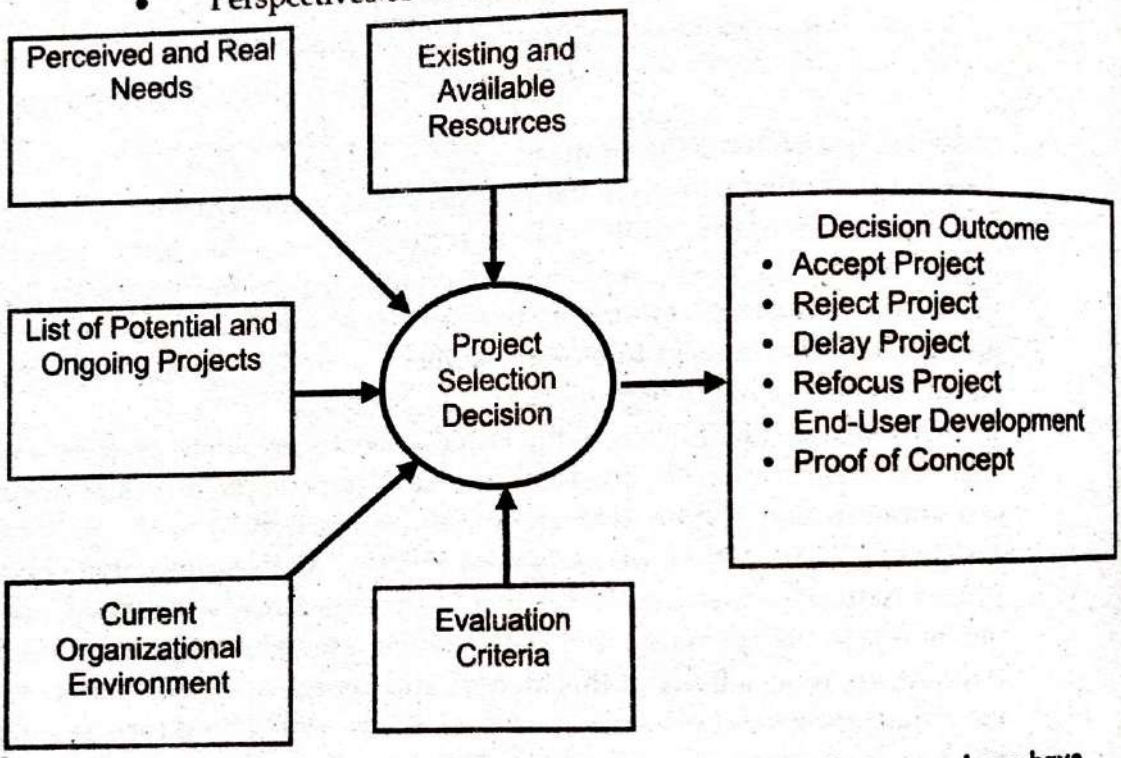


Figure: Project selection decisions must consider numerous factors and can have numerous outcomes

This decision-making process can lead to numerous outcomes. Of course, projects can be accepted or rejected. Acceptance of a project usually means that funding to conduct the next SDLC activity has been approved, Rejection means that the project will no longer be considered for development. However, projects may also be conditionally accepted; projects may be accepted pending the approval or availability of needed resources or the demonstration that a particularly difficult aspect of the system can be developed. Projects may also be returned to the original requesters who are told to develop or purchase the requested system themselves. Finally, the requesters of a project may be asked to modify and resubmit their request after making suggested changes or clarifications.

4. Define process modeling. Explain DFD with example. [1+4]

Ans: Process modeling involves graphically representing the processes, or actions, that capture, manipulate, store, and distribute data between a system and its environment and among components within a system. A common form of a process model is a data-flow diagram (DFD).

Data-flow diagram (DFD)

A data flow diagram shows the way information flows through a process or system. It includes data inputs and outputs, data stores, and the various sub-processes the data moves through. DFDs are built using standardized symbols and notation to describe various entities and their relationships.

Data flow diagrams visually represent systems and processes that would be hard to describe in just words. You can use these diagrams to map out an existing system and make it better or to plan out a new system for implementation. Visualizing each element makes it easy to identify inefficiencies and produce the best possible system.

DFD use a number of symbols to represent system. Most data flow modeling methods use 4 kinds of symbols to represent 4 kinds of system components: processes, data stores and external entities.

Symbols	Descriptions
Process	A process shows a transformation or manipulation of data flow within the system. A process transforms incoming data flow into outgoing data flow.
External entity	External entity is outside the system, but they either supply input into the system or use system output. External entity is representing by a rectangle.
Data Flows	A data flow shows flow of information from source to destination. A data flow is represented by a line with arrow head showing the direction of flow.
Database	Database Is huge collection of data. it is used for storage purpose.

Example: DFD for Result management system

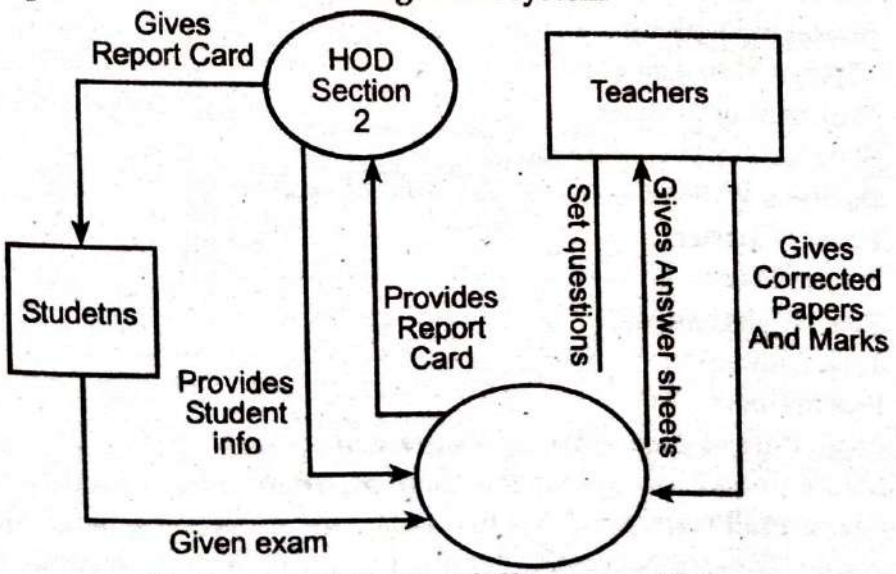


Fig: level 0 DFD for Result Management System

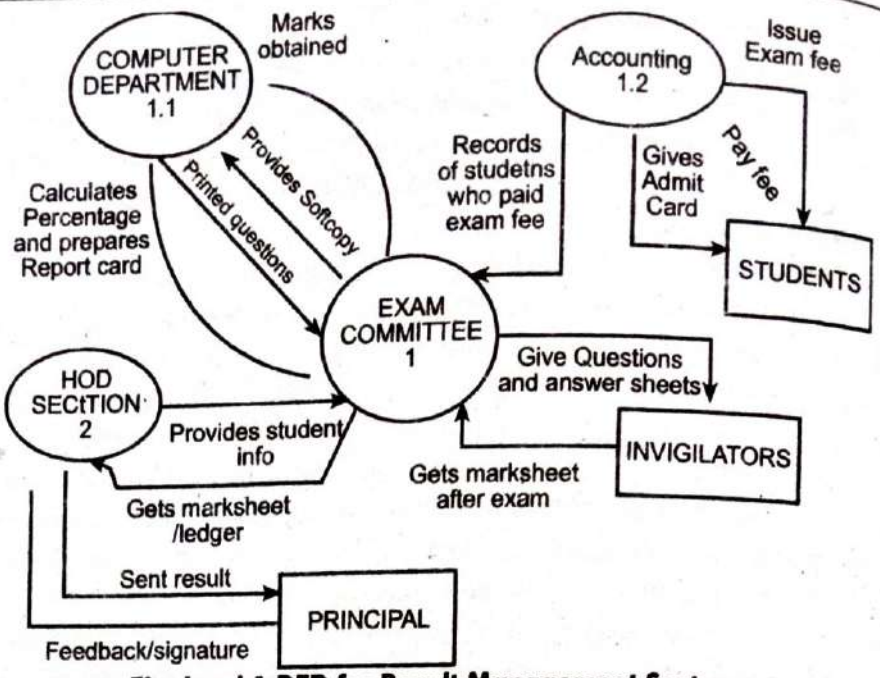


Fig: level 1 DFD for Result Management System

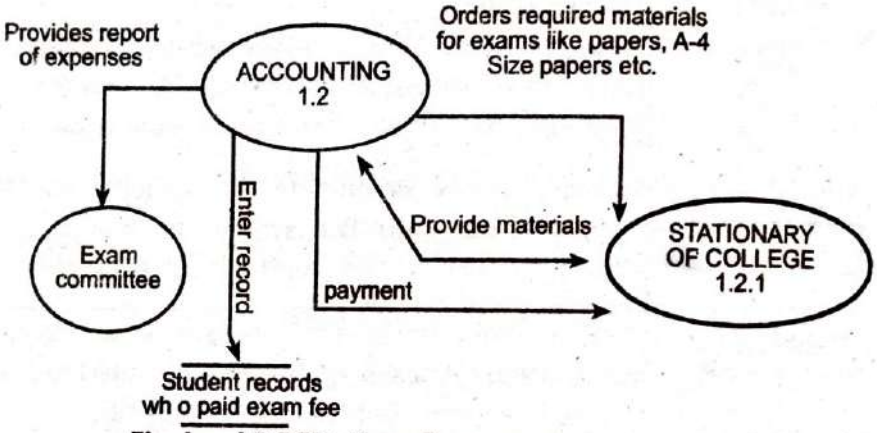


Fig: level 2 DFD of result management system

5. List and explain the skills and responsibilities of project manager. [2.5+2.5]

Ans: The skills of project manager are listed below:

- Organizational Culture
- Career Development
- Strategic Thinking
- Change Management
- Project Management
- Stakeholder Management
- Business Writing
- Project Charter
- Project Planning
- Risk Management
- Task Estimation
- Procurement

Responsibilities of project manager are listed below:

A software project manager is the most important person inside a team who takes the overall responsibilities to manage the software projects and play an important role in the successful completion of the projects. A project manager

has to face many difficult situations to accomplish these works. In fact, the job responsibilities of a project manager range from invisible activities like building up team morale to highly visible customer presentations.

The task of a project manager are classified into two major types:

1. Project planning
2. Project monitoring and control

Project planning

Project planning is undertaken immediately after the feasibility study phase and before the starting of the requirement analysis and specification phase. Once a project has been found to be feasible, Software project managers started project planning. Project planning is completed before any development phase starts. Project planning involves estimating several characteristics of a project and then plan the project activities based on these estimations. Project planning is done with most care and attention. A wrong estimation can result in schedule slippage. During the project planning the project manager performs the following activities:

a. **Project Estimation:** Project Size Estimation is the most important parameter based on which all other estimations like cost, duration and effort are made.
   - **Cost Estimation:** Total expenses to develop the software product is estimated.
   - **Time Estimation:** The total time required to complete the project.
   - **Effort Estimation:** The effort needed to complete the project is estimated.

   The effectiveness of all later planning activities is dependent on the accuracy of these three estimations.

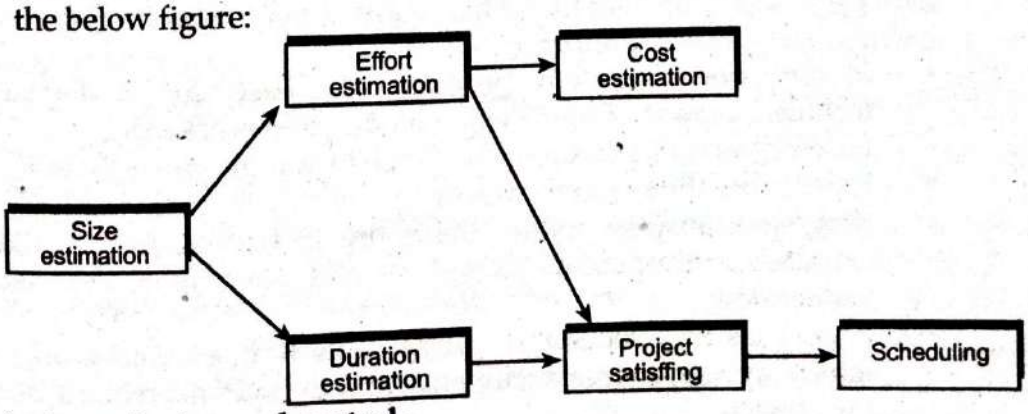
b. **Scheduling:** After completion of estimation of all the project parameters, scheduling for manpower and other resources are done.

c. **Staffing:** Team structure and staffing plans are made.

d. **Risk Management:** The project manager should identify the unanticipated risks that may occur during project development risk, analysis the damage might cause these risks and take risk reduction plan to cope up with these risks.

e. **Miscellaneous plans:** This includes making several other plans such as quality assurance plan, configuration management plan, etc.

   The order in which the planning activities are undertaken is shown in the below figure:



Project monitoring and control

Project monitoring and control activities are undertaken once the development activities start. The main focus of project monitoring and

control activities is to ensure that the software development proceeds as per plan. This includes checking whether the project is going on as per plan or not if any problem created then the project manager must take necessary action to solve the problem.

6. Explain the guidelines to design in an interface and dialogue box for e-commerce system. [5]

Ans: Dialogues are analogous to conversation between two people. A good human-computer interface provides a unifying structure for finding viewing and invoking the different components of a system.

Similar to designing forms and reports, the process of designing interfaces and dialogues is a user-focused activity. This means that you follow a prototyping methodology of iteratively collecting information, constructing a prototype, assessing usability, and making refinements. To design usable interfaces and dialogues, you must answer the same who, what, when, where, and how questions used to guide the design of forms and reports. Thus, this process parallels that of designing forms and reports.

Deliverables and outcomes

The deliverable and outcome from system interface and dialogue design is the creation of a design specification. This specification is also similar to the specification produced for form and report designs—with one exception:

1. Narrative overview
2. Sample design
3. Testing and usability assessment

For interface and dialogue designs, one additional subsection is included: a section outlining the dialogue sequence—the ways a user can move from one display to another.

7. Differentiate between system and user documentation with their applications. [5]

Ans: Documentation is one of the systems which are used to communicate, instruct and record the information for any reference or operational purpose. They are very useful for representing the formal flow of the present system. With the help of documentation it is very easy to track the flow of the system's progress and the working of the system can be explained very easily.

System documentation

System documentation serves as the technical specifications for the Information System and the objectives of the Information System. Users, managers and Information System owners need system documentation. It includes the following information:

- System documentation provides the basis for understanding the technical aspects of the IS when modifications are made.
- It describes each program within the IS and the entire IS itself.
- It describes the system's functions, the way they are implemented, each program's purpose within the entire IS with respect to the order of execution, information passed to and from programs, and overall system flow.
- It includes data dictionary entries, data flow diagrams, object models, screen layouts, source documents, and the systems request that initiated the project
- Most of the system documentation is prepared during the system analysis and system design phases.

- During systems implementation, an analyst must review system documentation to verify that it is complete, accurate, and up to date, and including any changes made during the implementation process.

It is intended for the people who will create or maintain the system. It explains in detail how the system accomplishes its work.

User documentation

It includes instructions and information to the users who will interact with the system. For example, user manuals, help guides, and tutorials. User documentation is valuable in training users and for reference purpose. It must be clear, understandable, and readily accessible to users at all levels.

The users, system owners, analysts, and programmers, all put combined efforts to develop a user's guide. User documentation should include:

- A system overview that clearly describes all major system features, capabilities, and limitations.
- Description of source document content, preparation, processing, and, samples.
- Overview of menu and data entry screen options, contents, and processing instructions.
- Examples of reports that are produced regularly or available at the user's request, including samples.
- Security and audit trail information.
- Explanation of responsibility for specific input, output, or processing requirements.
- Procedures for requesting changes and reporting problems.

It is intended for the people who will use the system to accomplish their own tasks. It explains how the system is used for the jobs or tasks of the end user. It does not explain how the system accomplishes its work as that is not relevant to the user's task.

8. Define software testing. Explain software quality assurance activities. [1+4]

Ans: Software testing is the process of evaluating and verifying that a software product or application does what it is supposed to do. The benefits of testing include preventing bugs, reducing development costs and improving performance. Software testing can be divided into two steps:

- **Verification:** it refers to the set of tasks that ensure that the software correctly implements a specific function.
- **Validation:** it refers to a different set of tasks that ensure that the software that has been built is traceable to customer requirements.

Software Quality Assurance (SQA) is simply a way to assure quality in the software. It is the set of activities which ensure processes, procedures as well as standards are suitable for the project and implemented correctly.

Software Quality Assurance is a process which works parallel to development of software. It focuses on improving the process of development of software so that problems can be prevented before they become a major issue. Software Quality Assurance is a kind of Umbrella activity that is applied throughout the software process.

Major Software Quality Assurance Activities:

- **SQA Management Plan:** Make a plan for how you will carry out the SQA throughout the project. Think about which set of software engineering activities are the best for project. Check level of SQA team skills.

- **Set The Check Points:** SQA team should set checkpoints. Evaluate the performance of the project on the basis of collected data on different check points.
- **Multi testing Strategy:** Do not depend on a single testing approach. When you have a lot of testing approaches available use them.
- **Measure Change Impact:** The changes for making the correction of an error sometimes re introduces more errors keep the measure of impact of change on project. Reset the new change to change check the compatibility of this fix with whole project.
- **Manage Good Relations:** In the working environment managing good relations with other teams involved in the project development is mandatory. Bad relation of SQA team with programmers' team will impact directly and badly on project. Don't play politics.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. What are the major differences between Agile methodologies and waterfall model? Why should you use agile methodologies? Explain. [5+5]

Ans: Major differentiate between Agile and Waterfall Model

Agile	Waterfall
It separates the project development lifecycle into sprints.	Software development process is divided into distinct phases.
It follows an incremental approach	Waterfall methodology is a sequential design process.
Agile methodology is known for its flexibility.	Waterfall is a structured software development methodology so most times it can be quite rigid.
Agile can be considered as a collection of many different projects.	Software development will be completed as one single project.
Agile is quite a flexible method which allows changes to be made in the project development requirements even if the initial planning has been completed.	There is no scope of changing the requirements once the project development starts.
Agile methodology, follow an iterative development approach because of this planning, development, prototyping and other software development phases may appear more than once.	All the project development phases like designing, development, testing, etc. are completed once in the Waterfall model.
Test plan is reviewed after each sprint	The test plan is rarely discussed during the test phase.
Agile development is a process in which the requirements are expected to change and evolve.	The method is ideal for projects which have definite requirements and changes not at all expected.
In Agile methodology, testing is performed concurrently with software development.	In this methodology, the "Testing" phase comes after the "Build" phase
Agile introduces a product mindset where the software product satisfies needs of its end customers and changes itself as per the customer's demands.	This model shows a project mindset and places its focus completely on accomplishing the project.

Agile methodology works exceptionally well with Time & Materials or non-fixed funding. It may increase stress in fixed-price scenarios.	Reduces risk in the firm fixed price contracts by getting risk agreement at the beginning of the process.
Prefers small but dedicated teams with a high degree of coordination and synchronization.	Team coordination/synchronization is very limited.
Products owner with team prepares requirements just about every day during a project.	Business analysis prepares requirements before the beginning of the project.
Test team can take part in the requirements change without problems.	It is difficult for the test to initiate any change in requirements.
Description of project details can be altered anytime during the SDLC process.	Detail description needs to implement waterfall software development approach.
The Agile Team members are inter-changeable; as a result, they work faster. There is also no need for project managers because the projects are managed by the entire team	In the waterfall method, the process is always straightforward so, project manager plays an essential role during every stage of SDLC.

Agile methodology

The Agile methodology is a way to manage a project by breaking it up into several phases. It involves constant collaboration with stakeholders and continuous improvement at every stage. Once the work begins, teams cycle through a process of planning, executing, and evaluating.

Reasons for Choosing Agile Software Development

1. **Reduces Technical Debt:** Technical debt refers to the maintenance tasks required to support the existing product. Those tasks include defect resolution, refactoring, and testing. In a traditional project methodology, this technical debt can accumulate quickly as the team focuses on new feature development to keep pace with the project timeline.

   Agile software development helps keep technical debt to a minimum. Any defects, feature changes or other maintenance tasks are added to what is known as a product backlog. The team reviews the backlog during each sprint planning session to determine what to address next. Thus, each sprint is a new opportunity to fix defects along with new feature development.

2. **Easily and Quickly Adapt to Change:** Teams not only adapt to change in Agile, they are encouraged to embrace the practice. Agile acknowledges that customer needs change and that teams must be able to adapt. Working in time-boxed iterations means the team does not need to wait on a lengthy requirement change, review and approval process. Any change or maintenance item is added to the backlog and allotted to an upcoming sprint based on priority and business need.

3. **Using Agile for Mobile Application Development Creates Total Alignment and Transparency:** An Agile software development process requires a level of collaboration and involvement that one would not

find in a traditional waterfall project. In waterfall, each phase often only involves a specific set of individuals with expertise to accomplish the tasks for that phase. However, Agile is quite different.

Before each sprint, the entire team reviews, validates, and agrees on which user stories to assign to the sprint. The developers, analysts, testers, and product owner work together to accomplish the items assigned to the sprint. The team meets daily to keep everyone on the same page. Throughout the sprint, each team member verifies each feature and works closely with the developers to ensure it meets the customer's needs.

4. **Agile Software Development Minimize Risk:** Although teams do their best to plan the phases of a waterfall project, there is often a level of uncertainty that isn't typically found in Agile software development. The traditional approach to software development leaves product testing and release to the end of the project. Waiting until the end leaves the team unsure if the product meets the customer's needs.

   Using Agile for mobile application testing, teams get feedback almost daily and can act on that feedback immediately. Developing a product in sprints allows teams to quickly determine if they are on track and allows them to adjust almost immediately. Also, because sprints are customer-focused, the team can be sure they are producing value at every release.

5. **Higher Quality Product:** Waterfall methodology can negatively impact the quality of the product. In a waterfall methodology, project phases may be so full of features that developers must rush to complete them and little time is left for testing. As a result, they may not have the time needed for proper mobile application testing.

   On an Agile project, the team does not attempt to develop all features at once. Instead, the team assigns a smaller subset of features to each sprint. That way, the developers have more time to perfect those items before release. Furthermore, Agile's reliance on continuous integration (merging all developers' working copies to a shared repository several times a day) gives developers the chance to test issues daily and address them immediately. Working on a product in small incremental releases ensures that each sprint results in a fully tested and working product.

6. **Predictable Delivery Dates:** Waterfall projects revolve around lengthy project cycles that make it difficult for teams to predict a release date accurately. Agile iterations happen in time-boxed sprints that result in a working product at each release. Thus, the product owner knows that they will get new features at the end of every sprint.

7. **Better Stakeholder Engagement:** For Agile software development to be successful, it is important for the product owner to be engaged throughout the process. Unfortunately, that level of engagement doesn't happen in waterfall projects. In a waterfall project, stakeholders aren't inclined to participate past the requirements gathering phase and only re-engage during user acceptance testing (UAT). Unlike waterfall, product owners are very active participants in Agile sprints. This level

of involvement gives them a sense of ownership that encourages further engagement.

8. **User-Focused Testing:** Agile is about more than just adapting to change. It is about delivering what is most important to the customer. As such, the product owner works closely with the team to help them gain a clear understanding of what is needed. In Agile software development, user requirements are represented as "user stories." These stories define an action that provides value to the customer. The concept of user stories is a stark contrast to the rather lengthy list of requirements developed in a traditional development methodology.
9. **Greater Customer Satisfaction:** The product owner actively participates in the sprints during the Agile development and testing process. Their participation in this manner ultimately fosters a level of engagement that ensures their needs are being met. Not only that, they get to see a working product at the end of each sprint and will be pleased that their team can deliver releases more quickly and frequently.
10. **Better Project Control:** Teams work together, along with the product owner, to determine what goes into each sprint. That way, the team is on the same page about what needs to be delivered. Also, there is less of a chance of surprises or unplanned features making it into the build. Daily standup meetings keep everyone aware of project status so issues can be addressed quickly. Planning meetings allow teams to prepare for the upcoming sprint. Retrospectives help the team learn from prior sprints and apply new methods to improve in future sprints.

    Agile software development and testing follow a process that helps teams deliver a working product that provides value at the end of each sprint. Embracing change is one of the core tenets of the process. With Agile software development, teams can quickly adapt to requirements changes without negatively impacting release dates. Not only that, Agile helps reduce technical debt, improve customer satisfaction and deliver a higher quality product. Contact one of our testing experts today to learn how we can help you in your mobile application testing efforts.

10. How can you transform ER Diagram into relation? Explain with your own suitable example. [10]

Ans: After designing the ER diagram of system, we need to convert it to Relational models which can directly be implemented by any RDBMS like Oracle, MySQL etc.

To reduce given ER diagram into table simply we create a table for each entity set and for each relationship sets. And that assigned the name of the corresponding entity set or relationship set as table name. Generally the number of attribute of an entity set or relationship set equal to the degree of a corresponding table (fields of a table). To reduce given ER diagram into tables normally we divide ER diagram into following sections:

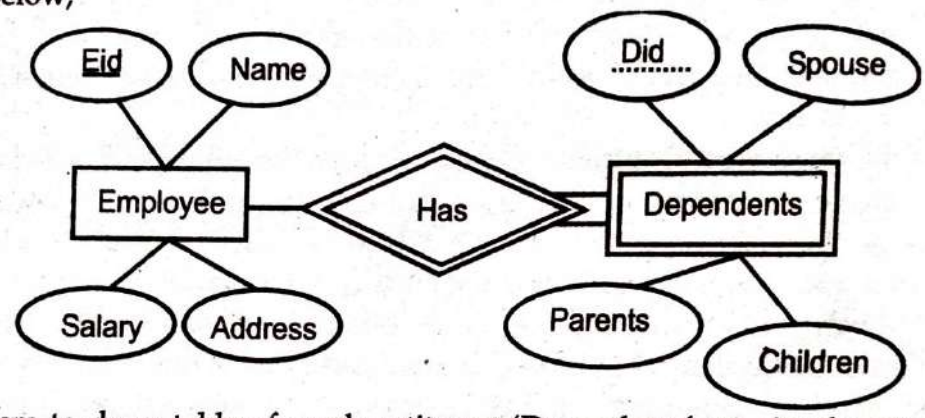
- Mapping entity sets to ER
- Mapping Relation sets to ER
- Mapping of multivalve attributes to ER
- Mapping composite attributes to ER
- Mapping of N-ary relationship types to ER

Mapping Entity Sets to ER

For each strong entity type E in the ER schema, simply, an entity set is mapped to a relation in a straightforward way: Each simple attribute of the entity set becomes an attribute (column) of the table and primary key of the entity set becomes primary key of the relation.

A weak entity set does not have its own primary key and always participates in one-to-many relationship with owner entity set and has total participation. For a weak entity set create a relation that contains all simple attributes (or simple components of composite attributes). In addition, relation for weak entity set contains primary key of the owner entity set as foreign key and its primary key is formed by combining partial key (discriminator) and primary key of the owner entity set.

Example: Let's take a weak entity set Dependents as shown in ER diagram below,



Here to draw table of weak entity set 'Dependents' we simply set all their attributes i.e. Did, spouse, Parents, children and also set primary key of Employee table to the Dependents table as below,

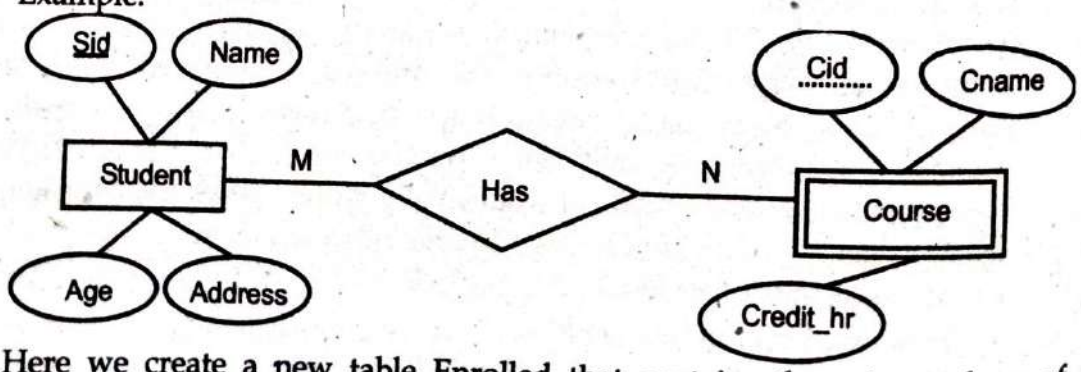
Employee			
Eid	Name	Salary	Address

Dependents				
Did	Did	Parents	Spouse	Children

Mapping Relation sets to ER

For mapping binary one to one relationship to relational model we simply set foreign key attribute to any one of the table. For mapping binary one to many relationship to relational model, we simply set foreign key attribute to the table of many side entity. Similarly, for mapping binary many to many relationship to relational model we construct a third table that contains the foreign key attribute of both tables.

Example:



Here we create a new table Enrolled that contains the primary keys of entities student and course entities as below:

Student

Sid	Name	Age	Address

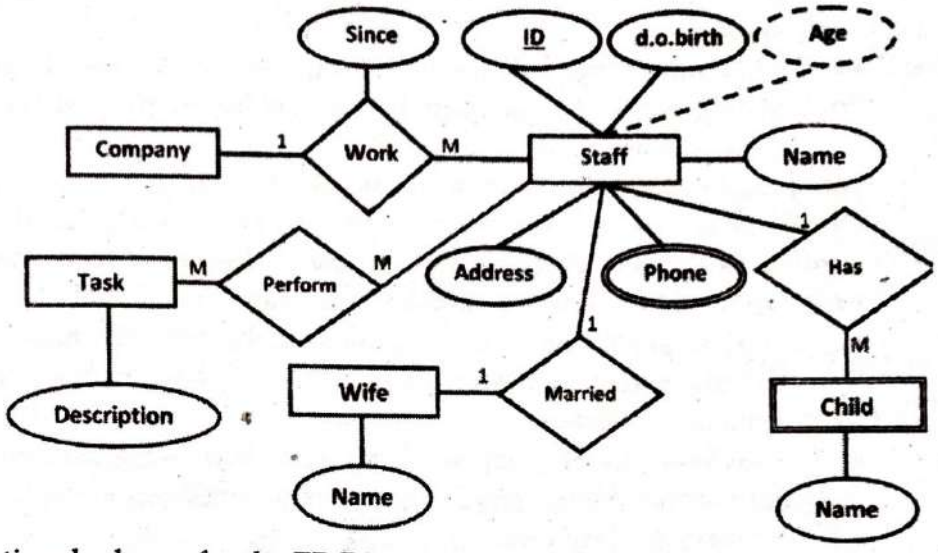
Course

Cid	Cname	Credit_hr

Enrolled

Cid	Cid

Let's take an example that handle all of the cases:



The relational schema for the ER Diagram is given below as:

Company(CompanyID , name , address)
Staff(StaffID , dob , address , WifeID)
Child(ChildID , name , StaffID)
Wife (WifeID , name)
Phone(PhoneID , phoneNumber , StaffID)
Task (TaskID , description)
Work(WorkID , CompanyID , StaffID , since)
Perform(PerformID , StaffID , TaskID)

11. Why is the project management important? Describe the concept of integrated CASE tools with its applications. [3+7]

Ans: Project management is important due to following reasons:

- **Strategic Alignment:** Project management is important because it ensures what is being delivered, is right, and will deliver real value against the business opportunity.
- **Leadership:** Project management is important because it brings leadership and direction to projects.
- **Clear Focus & Objectives:** Project management is important because it ensures there's a proper plan for executing on strategic goals.
- **Realistic Project Planning:** Project management is important because it ensures proper expectations are set around what can be delivered, by when, and for how much.
- **Quality Control:** Project management is important because it ensures the quality of whatever is being delivered, consistently hits the mark.
- **Risk Management:** Project management is important because it ensures risks are properly managed and mitigated against to avoid becoming issues.
- **Orderly Process:** Project management is important because it ensures the right people do the right things, at the right time – it ensures proper

project management process is followed throughout the project life cycle.

- **Continuous Oversight:** Project management is important because it ensures a project's progress is tracked and reported properly.
- **Subject Matter Expertise:** Project management is important because someone needs to be able to understand if everyone's doing what they should.
- **Managing and Learning from Success and Failure:** Project management is important because it learns from the successes and failures of the past.

Integrated CASE tools with its applications

CASE stands for computer-aided software engineering. CASE tools can be applied to support database development. There are three types of CASE tools: upper-CASE, lower-CASE, and integrated CASE tools:

- The upper-CASE tool supports database planning and design including data collection and analysis, data model generation and application design.
- The lower-CASE tool supports database implementation including data conversion, report generation, application code generation, prototyping, and testing.
- The integrated CASE tool supports all phases of database development and provides the functionality of both upper-CASE and lower-CASE in one tool.

CASE tools can also be independent or integrated. System documentation is often done using CASE tools that are independent of each other, to automate specific development activities such as data flow diagrams or ER diagrams. However, these individual tools may not share the same formats for sharing information. Any changes to the system mean that the time-consuming process of updating the documentation is often neglected. Future maintenance of the system then becomes extremely difficult.

In contrast, an integrated CASE environment focuses on the maintenance of design documents and CASE tools are used to handle activities throughout the entire system development. Integrated CASE tools use a common repository so that information can be shared across all tools and system development activities. Any changes to the design documents usually result in most other aspects of the system reflecting those changes.

MODEL QUESTIONS SETS FOR PRACTICE

MODEL SET 1

Bachelor in Computer Applications
Course Title: System Analysis & Design
Code No: CACS 203
Semester: III

Full Marks: 60
Pass Marks: 24
Time: 3 hours

Candidates are required to answer the questions in their own words as far as possible.

Group A

Attempt all the questions. **[10x1 = 10]**

1. Circle (O) the correct answer.

i. Which of the following is characteristic of an MIS?

a) Provides guidance in identify problems, finding and evaluating alternative solutions, and selecting or comparing alternatives
b) Draws on diverse yet predictable data resources to aggregate and summarize data
c) High-volume, data capture focus
d) Has as its goal the efficiency of data movement and processing and interfacing different TPS

ii. Which of the following Baseline Project Plan sections provides a brief description of alternative system configurations?

a) Management Issues
b) Feasibility Assessment
c) Introduction
d) System Description

iii. Referencing walkthrough roles, this person describes the work product to the group:

a) Coordinator
b) User
c) Maintenance oracle
d) Presenter

iv. In a DFD external entities are represented by a .....

a) Rectangle
b) ellipse
c) Diamond shaped box
d) circle

v. Who are the people that actually use the system to perform or support the work to be completed?

a) System analysts
b) system designers
c) System builders
d) none of the above

vi. In the implementation phase of system analysis and design, following are included....

a) Parallel run
b) Sizing
c) Specification freeze
d) All of the above

vii. System implementation is necessary because.....

a) Human never gets it right the first time
b) The development may change over time
c) The user's needs may change over time
d) All of the above

viii. **Which of the following points related to Object-oriented development (OOD) is true?**

a) OOA is concerned with developing an object model of the application domain
b) OOD is concerned with developing an object-oriented system model to implement requirements
c) All of the mentioned
d) None of the mentioned

ix. **Before developing a logical DFD it is a good idea to.....**

a) develop a physical DFD
b) develop a system flow chart
c) determine the contents of all data stores
d) find out user's preferences

x. **A feasibility document should contain all of the following except:**

a) project name
b) feasible alternative
c) data-flow diagrams
d) problem descriptions

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. What types of measurements must be taken to gain an understanding of the effectiveness of maintenance? Why is tracking mean time between failures an important measurement?
3. What is the use of class diagram? Explain use of class diagram with suitable example.
4. What is meant by usability and what characteristics of an interface are used to assess a system's usability?
5. What is JAD? How is it better than traditional information gathering techniques? What are its weaknesses?
6. Explain the RAD model. State the advantages and disadvantages of RAD approach.
7. Discuss the benefits, problems, and general design process for the use of color when designing system output.
8. In OOAD, there are various types of models, like conceptual, structural, behavioral etc. what is the significance of these many different types of model? Explain with illustrative example.

Group C

Attempt any TWO questions. [2x10 = 20]

9. Explain development methodology used in developing information system in detail with example.
10. Explain with example of the linking between data flow diagram, decision table and entity relationship diagram.
11. a). Draw a DFD diagram of student information system up to level 2.

    b). what are the key steps for designing ER diagram? Explain with example.

MODEL SET 2

Group A

Attempt all the questions. **[10x1 = 10]**

1. **Circle (O) the correct answer.**

i. True statements regarding the SDLC include each of the following except:
   a) Every organization uses a slightly different life cycle model.
   b) The life cycle is sequential.
   c) In the systems development life cycle, it is possible to complete some activities in one phase in parallel with some activities of another phase.
   d) Sometimes the life cycle is iterative.

ii. Cost reduction and avoidance, error reduction, and increased speed of activity are examples of:
   a) Intangible costs b) Tangible costs
   c) Tangible benefits d) Intangible benefits

iii. The final step of the system analysis phase in the SDLC is to
   a) Gather data b) write system analysis report
   c) Propose changes d) analyze data

iv. Form of dependency in which set of attributes that is neither a subset of any of keys nor candidate key is classified as .....
   a) Transitive dependency b) full functional dependency
   c) Partial dependency d) prime functional dependency

v. Modifying the software to match changes in the ever changing environment is called . . .
   a) Adaptive maintenance b) Corrective maintenance
   c) Perfective maintenance d) Preventive maintenance

vi. How is generalization implemented in Object Oriented programming languages?
   a) Inheritance b) Polymorphism
   c) Encapsulation d) Abstract Classes

vii. Data cannot flow between two data stores because
   a) it is not allowed in DFD
   b) a data store is a passive repository of data
   c) data can get corrupted
   d) they will get merged

viii. Some of the tools which are available with the system analysis are. . .
   a) Review of Documentation & Observation of the situation
   b) Conducting Interviews & Questionnaire Administration
   c) Both a & b
   d) Review of Procedure & Conducting Interviews

ix. A data flow can . . .
   a) only enter a data store
   b) only leave a data store
   c) enter or leave data store
   d) either enter or leave a data store but not both

x. . . . refers to the collection of information pertinent to systems project.
   a) Data gathering b) Data Exporting
   c) Data Embedding d) Data importing

Group B

Attempt any SIX questions. [6x5 = 30]

2. What is external agent in use case diagram? explain
3. What is the use of use case diagram? Explain with suitable example.
4. Prepare a list of dynamic model available in UML with brief detail.
5. Describe the activities involves in object oriented system development.
6. What is JAD? How is it better than traditional information gathering techniques? What are its weaknesses?
7. Describe how prototyping can be used during requirements determination. How is it better or worse than traditional methods?
8. What is meant by usability and what characteristics of an interface are used to assess a system's usability?

Group C

Attempt any TWO questions. [2x10 = 20]

9. What do you mean by information system? Explain the types of information systems with its applications.
10. What are the various steps of system development life cycle? What is the outcome of each step? Explain.
11. a) Explain the various steps of cost benefit analysis? What are the goal and design of cost/benefit analysis? Explain.
    b) What do you mean by normalization? Explain with suitable example.

MODEL SET 3

Group A

Attempt all the questions. [10x1 = 10]

1. Circle (O) the correct answer.

i. Which of the following is the most obvious end product of the systems development life cycle?
   a) Hardware
   b) Job descriptions
   c) Software
   d) A database

ii. Feasibility factors include:
   a) Political
   b) Legal and contractual
   c) Technical
   d) All of the above

iii. The key considerations involved in the feasibility analysis is/are.....
   a) Economic
   b) technical
   c) Behavioral
   d) all of the above

iv. A functional dependency is a relationship between or among.....
   a) tables
   b) rows
   c) relations
   d) attributes

v. Changes are made to the system to reduce the future system failure chances are called....
   a) Preventive Maintenance
   b) Adaptive Maintenance
   c) Corrective Maintenance
   d) Perfective Maintenance

vi. Which of the following is a disadvantage of OOD?
   a) Easier maintenance
   b) Objects may be understood as stand-alone entities
   c) Objects are potentially reusable components
   d) None of the mentioned

vii. To avoid errors in transcription and transposition, during data entry, the System Analyst should
   a) provide batch totals
   b) provide for a check digit
   c) provide for a hash totals
   d) All of the above

viii. Data structuring is refined through a process called.....
   a) normalization
   b) structuring process
   c) relation structure
   d) hierarchical structure

ix. A physical DFD.....
   a) has no means of showing material flow
   b) does not concern itself with material flow
   c) can show only stored material
   d) can show the flow of material

x. Which of the following is/are major step/s of system design?
   a) Specification of system output
   b) Development of system flowchart
   c) Development of program specifications
   d) All a, b, c

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. List four contributing factors that have acted to impede the design of high-quality interfaces and dialogues on Internet-based applications.
3. What is the purpose of normalization?
4. What is the purpose of de-normalization? Why might you not want to create one physical table or file for each relation in a logical data model?
5. List the steps in the maintenance process and contrast them with the phases of the SDLC.
6. What are the different types of maintenance and how do they differ?
7. What is meant by usability and what characteristics of an interface are used to assess a system's usability?
8. Discuss the benefits, problems, and general design process for the use of color when designing system output.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. Explain the steps in the maintenance process and contrast them with the phase of the systems development life cycle.
10. Draw a DFD diagram of the following up to level 2, Front office of Hotel is responsible for all room reservations, room allocations and final settlement of bills. Any company or person can reserve rooms for their future stay. They have to indicate from what date to what day they need the room. They also have to indicate how many rooms are required. Sometimes the reservations could be cancelled or the dates or number of rooms changed. For reservation, cancellation or modification or rooms, customer receives an acknowledgment from the hotel.
11. Explain the steps of creating a decision table. How can you reduce the size and complexity of a decision table? Explain with example.

MODEL SET 4

Group A

Attempt all the questions. [10 × 1 = 10]

1. **Circle (O) the correct answer.**

i. Generating alternative initial designs would most likely be done during:
   a) Design b) Planning
   c) Implementation d) Analysis

ii. Which of the following is an activity that occurs during project initiation and planning?
   a) Project structuring b) Logical design
   c) Project planning d) Requirements determination

iii. In ER diagrams, rectangles are used to denote
   a) Entity types b) attribute types
   c) Key types d) structure types

iv. A relation in this form is free of all modification anomalies.
   a) First normal form b) Second normal form
   c) Third normal form d) Domain/key normal form

v. Knowledge of software program, design and structure is essential in . . .
   a) Black-box testing b) White-box testing
   c) Integration testing d) None of the above

vi. Choose the incorrect statement in terms of Objects
   a) Objects are abstractions of real-world
   b) Objects can't manage themselves
   c) Objects encapsulate state and representation information
   d) All of the mentioned

vii. A decision table facilitates conditions to be related to
   a) tables b) actions
   c) operation d) programs

viii. A _____ is an outline of a process that keeps develop successful information systems
   a) CASE tool b) Success Factors
   c) Phased Conversion d) System Development Life Cycle

ix. The _____ symbol is used in a flowchart to represent a calculation task.
   a) Start b) Input
   c) Output d) Process

x. Which of the following is not considered as a tool at the system design phase?
   a) pie chart b) decision table
   c) systems flowchart d) data-flow diagram

Group B

Attempt any SIX questions. [6 × 5 = 30]

2. Draw a class diagram for point of sale system with association and multiplicity.
3. What is the use of class diagram? Explain use of class diagram with suitable example.
4. What is software testing? Explain different types of testing.
5. Briefly explain the CASE tools.

6. State the activities involved in Object-Oriented Development Life Cycle.
7. What is Class diagram? Draw a class diagram for Payment and Purchase of Customer.
8. Explain the steps of information gathering with example.

Group C

Attempt any TWO questions. [2x10 = 20]

9. What is information system? Why do we need it? Discuss different types of information systems with suitable example.
10. Draw context diagram and data flow diagrams for a distance education university described in the following narrative. Students send in an application form containing their personal details, and their desired course. The university checks that the course is available and that the student has necessary academic qualifications. If the course is available the student is enrolled in the course and the university confirms the enrolment by sending a confirmation letter to the student. Of the course is unavailable the student is sent a rejection letter
11. Compare object-oriented analysis and design with the structured analysis and design. State the activities involved in each of the phases of the object oriented development life cycle.

MODEL SET 5

Group A

Attempt all the questions. **[10 × 1 = 10]**

1. Circle (O) the correct answer.

i. During the analysis phase, the project team:
   a) Describes the functional features of the system chosen for development in the previous phase.
   b) Studies the organization's current procedures and the information systems used to perform organizational tasks.
   c) Determines the scope of the proposed systems and produces a specific plan for the proposed project.
   d) Codes, tests, and installs the new system.

ii. The primary deliverable from the project identification and selection phase is a:
   a) Schedule of specific IS development projects
   b) Statement of Work.
   c) Mission statement
   d) Design strategy.

iii. In constructing ER diagrams, double ovals are used to denote
   a) Multi-value table
   b) multi-value entity
   c) Multi-value attributes
   d) multi-value key

iv. One solution to the multivalued dependency constraint problem is to.....
   a) split the relation into two relations, each with a single theme.
   b) change the theme.
   c) create a new theme.
   d) add a composite key.

v. In software maintenance removing errors spotted by users is known as __.
   a) Adaptive
   b) Corrective
   c) Perfective
   d) Preventive

vi. Which of the following early OOD methods incorporates both a "micro development process" and a "macro development process."?
a) Booch method
b) Rumbaugh method
c) Wirfs-Brock method
d) Coad and Yourdon method

vii. An example of a hierarchical data structure is
a) tree
b) array
c) link list
d) All of the above

viii. Which of the following appropriately explains the desirable characteristic of good system design?
a) Conversion
b) Long discussions
c) Modular approach
d) Proper documentation

ix. Positive testing is. . .
a) running the system with line data by the actual user
b) testing changes made in an existing or a new program
c) is checking the logic of one or more programs in the candidate system
d) making sure that the new programs do in fact process certain transactions according to Specifications

x. Decision tree uses.....
a) nodes and branches
b) pictorial depiction of alternate conditions
c) consequences of various depicted alternates
d) All of the above

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. Explain interpersonal communication skill and interpersonal relations skills needed by systems analysis.
3. A system costs Rs. 1, 00, 000 to install and Rs. 8, 000 per month as recurring expenses. The benefit per year is Rs. 1, 50, 000. Assuming an interest rate is 14%. What is the payback period of the investment?
4. Discuss the process of designing forms and reports.
5. What are the four approaches to installation? Which is the most expensive? Which is the most risky? How does an organization decide which approach to use?
6. How do you calculate information systems development project schedule? Discuss.
7. What is software quality? Discuss different software quality assurance activities.
8. Differentiate between object modeling and dynamic modeling.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. Choose a transaction that you are likely to encounter, perhaps ordering a cap and gown for graduation, and develop a high-level DFD or a context diagram. Decompose this to a level-0 diagram.
10. A database is being constructed to keep track of the teams and games of a sports league. A team has a number of players, not all of whom participate in each game. It is desired to keep track of the players participating in each game for each team, the positions they played in that game, and the result of the game. Design an ER schema diagram for this application, stating any assumptions you make.
11. Describe the process for controlling maintenance requests. Should all requests be handled in the same way or are there situations when you should be able to circumvent the process? If so, when and why?

MODEL SET 6

Group A

Attempt all the questions. [10x1 = 10]

1. Circle (O) the correct answer.

i. During logical design, the project team:

a) Describes the functional features of the system chosen for development in the previous phase.

b) Studies the organization's current procedures and the information systems used to perform organizational tasks.

c) Determines the scope of the proposed systems and produces a specific plan for the proposed project.

d) Codes, tests, and installs the new system.

ii. Which of the following is viewed as a top-down source?

a) Business units' b) Steering committee

c) Managers d) Development group

iii. Weak entities are used in entity relationship diagrams and are denoted by

a) Double rectangles b) double square

c) Double ovals d) double squares

iv. A function that has no partial functional dependencies is in .....form

a) 3NF b) 2NF

c) 4NF d) BCNF

v. Give the Real-world factors affecting maintenance Cost.

a) As technology advances, it becomes costly to maintain old software.

b) The standard age of any software is considered up to 10 to 15 years.

c) Most maintenance engineers are newbie and use trial and error method to rectify problem.

d) All mentioned above

vi. A design description in OOD includes

a) Protocol Description

b) Implementation Description

c) Type Description

d) both Protocol and Implementation Description

vii. Documentation is prepared. . .

a) at every stage b) at system design

c) at system analysis d) at system development

viii. System Implementation Phase entails

a) Pilot run b) Parallel runs

c) System check outs d) All of the above

ix. Which of the following is not true of the conversion phase of the development life cycle?
   a) documentation should be emphasized
   b) steps must be taken to phase out the old system
   c) the user and systems personnel must work closely together
   d) the non-machine components of the system should be considered

x. Which of the following is not a characteristic of good test data?
   a. should be comprehensive
   b. every statement should be executed
   c. users do not participate at this preliminary stage
   d. All of the above

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. What is file? Explain any technique for implementing records in file.
3. What is software testing? Explain different types of testing.
4. State the activities involved in Object-Oriented Development Life Cycle.
5. Who is system analyst? Discuss the roles of system analyst.
6. How has systems analysis and design changed over the past four decades?
7. What do you mean by analysis and design? What are the main underlying concepts of object orientation?
8. What is meant by configuration management? Why do you think organizations have adopted the approach of using a systems librarian?

Group C

Attempt any TWO questions. [2x10 = 20]

9. Explain the use of structure chart in structured design with a suitable example.
10. How to construct a checklist for design review? Explain.
11. Define the concept of Integrated CASE tools. How are they useful?

MODEL SET 7

Group A

Attempt all the questions. **[10 × 1 = 10]**

1. Circle (O) the correct answer.

i. During implementation, the project team:
   a) Concentrates on the business aspects of the system and tends to be oriented to a high level of specificity.
   b) Studies the organization's current procedures and the information systems used to perform organizational tasks.
   c) Determines the scope of the proposed systems and produces a specific plan for the proposed project.
   d) Codes, tests, and installs the new system.

ii. Which of the following is characteristic of information systems identification and selection decisions made by user department?

a) Greater strategic focus
b) Greater organizational change
c) Less concern on cost-benefit analysis
d) faster development

iii. Which of the following is not a requirement of structured design?

a) It should use many GO TO statements
b) The code should be executed in a top-to-bottom fashion within each module
c) It should be made up of a hierarchy of modules
d) Each module should be as independent as possible of all other modules, except its parent

iv. at highest level, a DFD is referred to as.....

a) Scope diagram
b) Context diagram
c) Level 1 DFD
d) Level 2 DFD

v. A BCNF is.....

a) loss less join and dependency preserving
b) loss less join but not dependency preserving
c) not loss less join but dependency preserving
d) none of these

vi. Maintenance is classified into how many categories?

a) Two
b) three
c) Four
d) five

vii. Which of the following is not an operation as per OOD algorithms and data structures?

a) operations that manipulate data in some way
b) operations that perform a computation
c) operations that check for syntax errors
d) operations that monitor an object for the occurrence of a controlling event

viii. In flowcharts, symbol of rectangle is used to represent

a) operations on data
b) system process
c) manual operations
d) magnetic disc

ix. In a _____ one module of the new information system is activates at a time.

a) CASE tool
b) Success factors
c) Phased Conversion
d) System Development Life Cycle

x. Which are the tools not used for System Analysis

a) Flow charts
b) Decision table
c) System - test data
d) Data Flow Diagram

Group B

Attempt any SIX questions. [6x5 = 30]

2. What are disruptive technologies and how do they enable organizations to radically change their business processes?
3. What intangible benefits might an organization obtain from the development of an information system?
4. What is framework? How design pattern is useful? Explain any one design pattern in detail with suitable example.
5. What is the conventional wisdom about implementation success?
6. List and define the factors that are important to successful implementation efforts.
7. Describe five methods of interacting with a system. Is one method better than all others? Why or why not?
8. List and describe the common interface and dialogue design errors found on websites.

Group C

Attempt any TWO questions. **[2 × 10 = 20]**

9. Draw an ER diagram for database showing Bank. Each Bank can have multiple branches, and each branch can have multiple accounts and loans.
10. Draw a DFD diagram of following up to level 2.
    Customer sends enquiry to commercial department; receives quotations from the sales department and places an order. Based on the customer order, the work order is sent to the planning department for planning scheduling and control, in turn, the planning department raises a job order on the "shop floor". On completion, delivery note and invoice are made out costing department also prepares an order wise comparative statement of estimated and actual costs.
11. Explain the steps in the maintenance process and contrast them with the phase of the systems development life cycle.

MODEL SET 8

Group A

Attempt all the questions. **[10 × 1 = 10]**

1. Circle (O) the correct answer.

i. A graphical representation of a project that shows each task as a horizontal bar whose length is proportional to its time for completion best describes:
   a) Work breakdown structure b) Decision tree
   c) Network diagram d) Gantt chart

ii. Which of the following is characteristic of information systems identification and selection decisions made by top management?
   a) Greater strategic focus
   b) Greater organizational change
   c) Less concern on cost-benefit analysis
   d) faster development

iii. The data flow diagram (DFD) shows.....
a) The flow of data
b) The processes
c) The areas where they are stored.
d) All of the above

iv. A Relation is a.....
a) Subset of a Cartesian product of a list of attributes
b) Subset of a Cartesian product of a list of domains
c) Subset of a Cartesian product of a list of tuple
d) Subset of a Cartesian product of a list of relations

v. What type of software testing is generally used in Software Maintenance?
a) Regression Testing
b) System Testing
c) Integration Testing
d) Unit Testing

vi. Which model describes the static structure of the system using object classes and their relationships?
a) Sequence model
b) Subsystem model
c) Dynamic model
d) Structural model

vii. In a flowchart, circle with a vertical line drawn is a symbol used to show
a) systematic operation
b) manual operation
c) magnetic tape
d) display screen

viii. The primary tool used in structured design is a:
a) module
b) structure chart
c) data-flow diagram
d) program flowchart

ix. The step-by-step instructions that solve a problem are called _____.
a) A list
b) A plan
c) An algorithm
d) A sequential structure

x. The approach used in top-down analysis and design is
a) to prepare flow charts after programming has been completed
b) to identify the top level functions by combining many smaller components into a single entity
c) to identify a top level function an d then create a hierarchy of lower-level modules and components
d) All of the above

Group B

Attempt any SIX questions. [6x5 = 30]

2. Why is continual user involvement a useful way to discover system requirements? Under what conditions it might be used? Under what conditions might it not be used?
3. Describe three commonly used methods for performing economic cost-benefit analysis.
4. Explain Agile Methodologies. When would you use agile methodologies?
5. What is framework? How design pattern is useful? Explain any one design pattern in detail with suitable example.
6. In OOAD, there are various types of models, like conceptual, structural, behavioral etc. what is the significance of these many different types of model? Explain with illustrative example.

7. How does the requirement elicitation process happen in object oriented analysis? Explain with reference to system behavior analysis of any exemplary system case.
8. What are the four approaches to installation? Which is the most expensive? Which is the most risky? How does an organization decide which approach to use?

Group C

Attempt any TWO questions. [2x10 = 20]

9. How can you transforming E-R diagram into relations? Explain with suitable example.
10. Draw a DFD diagram of the following up to level 2

    Front office of Hotel is responsible for all room reservations, room allocations and final settlement of bills. Any company or person can reserve rooms for their future stay. They have to indicate from what date to what day they need the room. They also have to indicate how many rooms are required.

    Sometimes the reservations could be cancelled or the dates or number of rooms changed. For reservation, cancellation or modification or rooms, customer receives an acknowledgement from the hotel.
11. Explain the steps of creating a decision table. How can you reduce the size and complexity of a decision table? Explain with example.

□□□

Web Technology

Course Title: Web Technology (3 Cr.)

Course Code: CACS205

Year/Semester: II/III

Class Load: 6 Hrs./Week (Theory: 3 Hrs, Practical:3 Hrs.)

Course Description:

This course covers different aspect of web technology such as HTML, CSS, and issues of web technology, client tier, server tier and advanced server side issue.

Course Objectives

The general objectives of this course are to provide fundamental concepts of Internet, Web Technology and Web Programming.

Course Content

Unit 1 HTML and CSS **15 Hrs.**

HTML Basic: HTML Tag Reference, Global Attributes, Document, Structure Tags, Formatting Tags, Text Level Formatting, Block Level foom1atting, List Tags, Hyperlink Tags. Executable Content Tags.

Image & Imagemaps: Introduction, Client-Side Imagemaps, Server-Side Imagemaps. Using Server-Side and Client-Side Imagempas Together, Alternative Text for Imagemaps.

Tables: Introduction To HTML Tables and Their Structure, The Table Tags, Alignment, Aligning Entire Table, Alignment within a Row, Alignment within a Cell, Attributes, Content Summary, Background Color, Adding Caption, Setting the Width, Adding a Border, Spacing Within a Cell, Spacing between the Cells, Spanning Multiple Rows or Columns, Elements that can be Placed in a Table, Table Sections and Column Properties, Tables as a Design Tool.

Frames: Introduction to Frames, Applications, Frames document, The <PRAMESET> tag, Nesting <FRAMESET> tag, Placing content in frames with the <FRAMEME>Tag, Targeting named Frames, Creating Floating Frames, Using Hidden Frames.

Forms: Creating Forms, the <FORM> tag, Named Input fields, The <INPUT> tag, multiple lines text windows, Drop Down and List Boxes, Hidden, Text, Text Area. Password, File Upload, Button, Submit, Reset, Radio, Checkbox, Select. Option, Forms and Scripting, Action Buttons, Labeling input files, Grouping related fields, Disabled and read-only fields, Form field event handlers, Passing form data.

Style Sheets: Definition, Importance, Different Approaches to Style Sheets. Using Multiple Approaches, Linking to Style Information in Separate File, Setting up Style Information, Using <STYLE> tag, Linline style Information.

Unit 2 Issue of Web Technology **3 Hrs.**

Architectural Issues of Web Layer. Tier Technology: 2-Tier, 3-Tier and n-Tier.

Unit 3 the Client Tier **10 Hrs.**

Representing Content; Introduction to XMT.; Elements and Attributes; Rules for Writing XML; Namespaces; Schema: Simple, Types and Complex Types, XSD Attributes, Default and Fixed Values, Facts, Use of Patterns, Order Indicators (AIL Choice, Sequences), Occurrence indicators (Maxoccurs, Minoccurs). DTD: Internal Declaration. Private External Declaration, Public External Declaration, Defining Elements and Attributes; XSL/XSLT; Xpath; Xquery; SAX; DOM. Creating XMT, Parser.

Unit 4 the Server Tier **8 Hrs.**

Web Server Concept; Creating Dynamic Content. Using Control Flow to Control Dynamic Content Generation, Sessions and State, Error Handling. Architecting Web Application Using Tag Libraries, Writing Tag Libraries.

Unit 5 Introduction to Advanced Server Side Issues **9Hrs.**

Database Connectivity; Creating an SQL statement: Select, Insert, Update and Delete; Authentication: Anonymous Access, Authentication by IP address and Domain, Integrated Windows Authentication; Cookies; File Handling; Form Handling

Laboratory Works

Laboratory works should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course. Project should be assigned on individual basis.

Teaching Methods

The general teaching pedagogy includes class lecturer, group works, case studies, guest lectures, research work, and project work. Assignments (theoretical and practical), tutorials and examinations (written and verbal). The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

Evaluation

Examination Scheme				
Internal Assessment		Internal Assessment		Total
Theory	Practical	Theory	Practical	
20		60 (3 Hrs.)	20 (3 Hrs)	100

Text Books

1. Harvey M. Deitel, Paul J. Deitel & Abbey Deitel, "Internet and World Wide Web: How to Program", 5th Edition, Pearson Education, 2012, ISBN: 9780273764021
2. Thomas A. Powell, "HTML & CSS: The Complete Reference", McGraw Hill, Fifth Edition, 2010, ISBN: 978-0-07-174170-5

Reference Books

1. Matt J. Crouch, "ASP.NET and VR.NET Web Programming", Pearson Education Asia, 2002.
2. Rahul Banerjee, "Internetworking Technologies", Prentice-Hall of India Limited, Fourth Edition, 2000.
3. Thomas A. Powell, "Web Design: The Complete Reference", Tata McGraw Hill, Second Edition, 2002.

TRIBHUVAN UNIVERSITY

Faculty of Humanities & Social Sciences

OFFICE OF THE DEAN

TU QUESTIONS-ANSWERS 2019

Bachelor in Computer Applications
Course Title: Web Technology — **Full Marks: 60**
Code No: CACS 205 — **Pass Marks: 24**
Semester: III — **Time: 3 hours**

Candidates are required to answer the questions in their own words as far as possible.

Group A

Attempt all the questions.

1. Circle (O) the correct answer. **[10x1 = 10]**

i) Which of the following provide additional information about HTML elements?
   a) Headings
   b) Paragraphs
   c) Attributes
   d) Styles

ii) Which of the following is NOT an inline element?
   a) <img>
   b)
   c) <input>
   d) None of the above

iii) How can you make an e-mail link?
   a) <a href="mailto:xxx@yyy”>
   b) <mail href="xxx@yyy ">
   c) <mail>xxx@yyy </mail>
   d) <a href="xxx@yyy ">

iv) For XML document to be valid?
   a) Document need to be well formed also
   b) Document need not to be well formed
   c) Document need to be well formed & valid
   d) Document validity has no relationship with well formedness

v) W3C is stands for.....
   a) World Wide Web Center
   b) World Wide Web Company
   c) World Wide Web Consortium
   d) World Wide Web Certificate

vi) XSL is.....
   a) AN XML based language to create style sheets
   b) Extensible solution language
   c) A language which is not used in XML
   d) Extended style sheet language

vii) CSS uses dot (.) for.....
   a) Element selector
   b) Class selector
   c) ID selector
   d) Attribute selector

viii) Namespace in XML is used to,.....
   a) Distinguishes one XML vocabulary from another
   b) Provides the spaces into name
   c) Querying language
   d) Make duplicate of XML validation

ix) A cookie is often used to identify a.....
   a) User
   b) Browser
   c) Web page
   d) Client

x) Server side scripts are.....
a) Visible to the end user
b) Invisible to the end user
c) Defined to user
d) none

Answer-Key

i. (c)	ii. (b)	iii. (a)	iv. (d)	v. (c)	vi. (a)	vii. (b)	viii. (a)	ix. (a)	x. (b)

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. What is CSS? Discuss types of CSS with example.

Ans: Cascading Style Sheet (CSS) is used to set the style in web pages which contain HTML elements. It sets the background color, font-size, font-family, color ... etc property of elements in a web page. There are three types of CSS which are given below:

a. Inline CSS
b. Internal or Embedded CSS
c. External CSS

Inline CSS

Inline CSS contains the CSS property in the body section attached with element is known as inline CSS. This kind of style is specified within an HTML tag using style attribute.

Example:

```
<!DOCTYPE html>
<html>
<head>
<title>Inline CSS</title>
</head>
<body>
<p style = "color:#009900; font-size:50px;
    font-style:italic; text-align:center;">
Web Technology
</p>
</body>
</html>
```

Internal or Embedded CSS

This can be used when a single HTML document must be styled uniquely. The CSS rule set should be within the HTML file in the head section i.e the CSS is embedded within the HTML file.

Example:

```
<!DOCTYPE html>
<html>
<head>
<title>Internal CSS</title>
<style>
  .main {
    text-align:center;
  }
  .WT {
    color:#009900;
    font-size:50px;
```

```
        font-weight:bold;
      }
      .webt {
        font-style:bold;
        font-size:20px;
      }
    </style>
  </head>
  <body>
    <div class = "main">
      <div class ="WT">Web Technology</div>

      <div class ="webt">
        A computer science and BCA course
      </div>
    </div>
  </body>
</html>
```

External CSS

External CSS contains separate CSS file which contains only style property with the help of tag attributes (For example class, id, heading ... etc). CSS property written in a separate file with .css extension and should be linked to the HTML document using link tag. This means that for each element, style can be set only once and that will be applied across web pages.

Example: The file given below contains CSS property. This file saves with .css extension. For Ex: web.css

```
body {
background-color:powderblue;
}
.main {
text-align:center;
}
.WT {
color:#009900;
font-size:50px;
font-weight:bold;
}
#webpro {
  font-style:bold;
font-size:20px;
}
```

Below is the HTML file that is making use of the created external style sheet

- LINK tag is used to link the external style sheet with the html webpage.
- HREF attribute is used to specify the location of the external style sheet file.

```
<! DOCTYPE html>
<HTML>
<HEAD>
<LINK rel="stylesheet" href="web.css"/>
```

```
    </HEAD>
    <BODY>
   <DIV class = "main">
     <DIV class ="WT">Web technology</DIV>
     <DIV id ="web">
        A computer science and BCA course book
     </DIV>
   </DIV>
  </BODY>
</HTML>
```

3. What is XML? Differentiate XML schema with DTD.

Ans: Extensible Markup Language (XML) is a markup language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable. It is a textual data format with strong support via Unicode for different human languages.

Example

```
<?xml version="1.0" encoding="UTF-8"?>
<note>
<to>Tove</to>
<from>Jani</from>
<heading>Reminder</heading>
<body>XML example!</body>
</note>
```

Differences between an XML Schema Definition (XSD) and Document Type Definition (DTD) include:

- XML schemas are written in XML while DTD are derived from SGML syntax.
- XML schemas define data types for elements and attributes while DTD doesn't support data types.
- XML schemas allow support for namespaces while DTD does not.
- XML schemas define number and order of child elements, while DTD does not.
- XML schemas can be manipulated on your own with XML DOM but it is not possible in case of DTD.
- Using XML schema user need not to learn a new language but working with DTD is difficult for a user.
- XML schema provides secure data communication i.e. sender can describe the data in a way that receiver will understand, but in case of DTD data can be misunderstood by the receiver.
- XML schemas are extensible while DTD is not extensible.

4. List common application of web server, Explain how session works.

Ans: Web server is a computer where the web content is stored. Basically web server is used to host the web sites but there exists other web servers also such as gaming, storage, FTP, email etc. Web site is collection of web pages while web server is software that responds to the request for web resources. Examples of Web Servers are: Apache Tomcat and Resin.

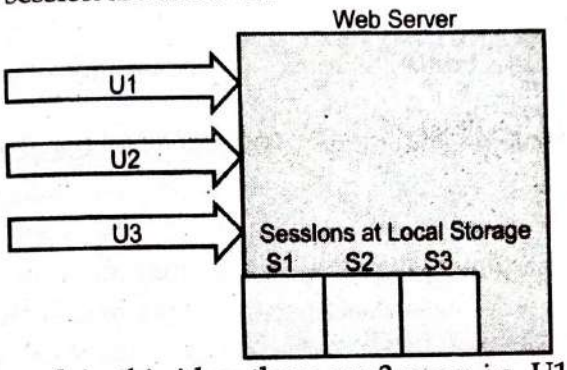
It can respond to the client request in either of the following two possible ways:

- Generating response by using the script and communicating with database.
- Sending file to the client associated with the requested URL.

Web servers often come as parts of a larger package of internet- and intranet-related programs that are used for:

- Sending and receiving emails.
- Downloading requests for File Transfer Protocol (FTP) files.
- Building and publishing Web pages.

Web developer may need to store small data temporarily at server side, for each user who is interacting with the web application. Such data is stored in a session, so session is a temporary storage at web server. For each user, there is unique session are at server.



Above picture explain this idea; there are 3 users i.e. U1, U2, U3 interacting with the web-server, so there are 3 sessions at server side, one for each user i.e. S1 for U1, S2 for U2 and S3 for U3.

If we save data in session for U1, it would be stored in S1 bucket or session. When we would get data for U1, it would be automatically read from S1 session. (Later I have explained how server keep track of which session bucket, belong to which user. In same way, data stored for U2 goes in S2, and so on.

5. Describe the tags and attributes for a form in HTML document?

Ans: HTML tags are the hidden keywords within a web page that define how your web browser must format and display the content. Most tags must have two parts, an opening and a closing part. For example, <html> is the opening tag and </html> is the closing tag. Note that the closing tag has the same text as the opening tag, but has an additional forward-slash (/) character. There are some tags that are an exception to this rule, and where a closing tag is not required. The <img> tag for showing images is one example of this. Each HTML file must have the essential tags for it to be valid, so that web browsers can understand it and display it correctly. The rest of the HTML file can contain as little or as many tags as you want to display your content.

Example:

```
<html>
 <head>
  <title>My Page Title</title>
 </head>
 <body>
  This is where all my web page content goes!
 </body>
</html>
```

Tag Attributes

Attributes allow us to customize a tag, and are defined within the opening tag, for example:

<img src="image1.jpg"> or ...

Attributes are often assigned a value using the equals sign, such as border="0" or width="50%", but there are some that only need to be declared in the tag like this:

<hr noshade>.

Most attributes are optional for most tags, and are only used when you want to change something about the default way a tag is displayed by the browser. However, some tags such as the <img> tag has required attributes such as src and alt which are needed in order for the browser to display the web page properly.

6. What is anonymous access? Discuss about Integrated windows authentication.

Ans: Anonymous access is the most common web site access control method. It allows anyone to visit the public areas of your web sites while preventing unauthorized users from gaining access to your web server's critical administrative features and private information.

Integrated Windows Authentication (IWA) is a built-in Microsoft Internet Information Services (IIS) authentication protocol that can be used to automatically authenticate and sign-in a user to EMS Web App. Integrated Windows Authentication works only with Internet Explorer and is best used on intranets where all clients accessing EMS Web App are within a single domain. When a domain user who is logged on to a networked PC accesses an EMS Everyday User application, such as EMS Web App, EMS Mobile App, or EMS for Outlook, their Active Directory credentials (Domain\User ID) are compared against corresponding Domain\User ID information recorded in the Network ID and\or External Reference fields of your EMS Everyday User records. If a match exists, the Everyday User will be automatically logged in.

Configuring Integrated Windows Authentication

1. Go to Configure > My Proxy > Basic > General. In the Authentication section, click Integrated Windows Authentication On, and click Apply.
2. Configure the Global authentication options.
3. Join the Windows domain.

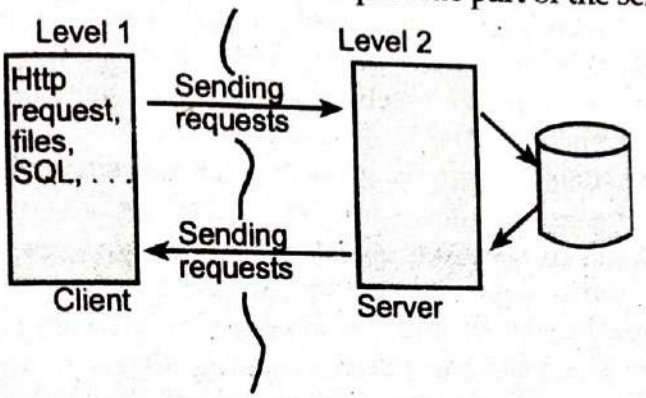
To join the domain:

- Content Gateway must be able to resolve the domain name.
- Content Gateway system time must be synchronized with the domain controller's time, plus or minus 1 minute.
- The correct domain Administrator name and password must be specified.
- There must be TCP/UDP connectivity to the domain controller(s) (ports 88, 389, 445).
- If backup domain controllers are configured, they and their Kerberos Distribution Center (KDC) services must be reachable by Content Gateway on the network.

7. **Explain tire technology with examples?**

Ans: Multitier architecture or multilayered architecture is client-server architecture in which presentation, application processing, and data management functions are physically separated. The most widespread use of multitier architecture is the three-tier architecture.

2-Tier Architecture: 2-tier architecture is used to describe client/server systems where the client requests resources and the server responds directly to the request, using its own resources. This means that the server does not call on another application in order to provide part of the service.

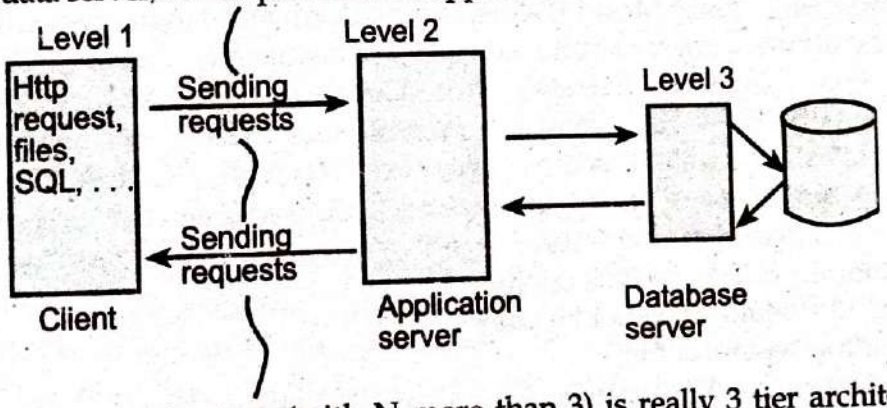


3-Tier Architecture: In 3-tier architecture, there is an intermediary level, meaning the architecture is generally split up between:

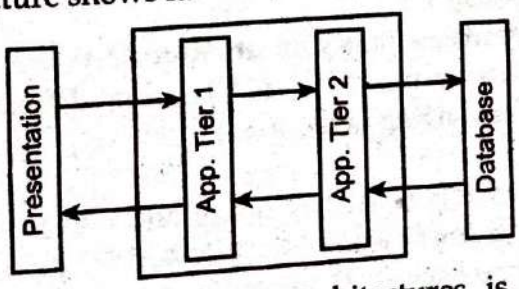
A client, i.e. the computer, which requests the resources, equipped with a user interface (usually a web browser) for presentation purposes

The application server (also called middleware), whose task it is to provide the requested resources, but by calling on another server

The data server, which provides the application server with the data it requires



An N-tier architecture (with N more than 3) is really 3 tier architectures in which the middle tier is split up into new tiers. The application tier is broken down into separate parts. What these parts are differs from system to system. The following picture shows it:



The primary advantage of N-tier architectures is that they make load balancing possible. Since the application logic is distributed between several servers, processing can then be more evenly distributed among those servers.

N-tiered architectures are also more easily scalable, since only servers experiencing high demand, such as the application server, need be upgraded. The primary disadvantage of N-tier architectures is that it is also more difficult to program and test an N-tier architecture due to its increased complexity.

8. **Write short note on following:**

- **Cookies**

Ans: Cookies are messages that web servers pass to your web browser when you visit Internet sites. Your browser stores each message in a small file, called cookie.txt. When you request another page from the server, your browser sends the cookie back to the server. These files typically contain information about your visit to the web page, as well as any information you've volunteered, such as your name and interests.

Cookies are most commonly used to track website activity. When you visit some sites, the server gives you a cookie that acts as your identification card. Upon each return visit to that site, your browser passes that cookie back to the server. In this way, a web server can gather information about which web pages are used the most, and which pages are gathering the most repeat hits. Cookies are also used for online shopping. Online stores often use cookies that record any personal information you enter, as well as any items in your electronic shopping cart, so that you don't need to re-enter this information each time you visit the site.

Servers can use cookies to provide personalized web pages. When you select preferences at a site that uses this option, the server places the information in a cookie. When you return, the server uses the information in the cookie to create a customized page for you.

- **XML DOM**

Ans: Document Object Model (DOM) is a platform and language-neutral interface that allows programs and scripts to dynamically access and update the content, structure, and style of a document. The HTML DOM defines a standard way for accessing and manipulating HTML documents. It presents an HTML document as a tree-structure. The XML DOM defines a standard way for accessing and manipulating XML documents. It presents an XML document as a tree-structure.

Example: HTML DOM example

```
<h1 id="demo">this is a Heading</h1>
<button type="button"
onclick="document.getElementById('demo').innerHTML = 'Hello
World!'">Click Me!
</button>
```

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. **Differentiate between tags and attributes? Write a HTML and CSS code design your curriculum vitae (CV) using different html elements like (table, image, formatting tags, links).**

Ans: HTML Tags

Tags are used to define the beginning and end of an HTML element. They consist of an opening bracket (<), followed by the name of the element and then a closing bracket (>). If an attribute is being used in the tag, it will be included after the element. Here's an example of the HTML title tag:

<title> <title>

HTML Attributes

Attributes are used to define a property for one or more HTML elements. They are found within the element's opening tag, often containing spaces that are separated by value pairs.

Here's an example of the HTML alt text attribute:

<img src="dogs-playing.gif" alt="dogs playing outside">

In this example, the HTML attribute is an alt text of "dogs playing outside" for the image "dogs-playing.gif." While images will typically render and display regardless of whether or not they contain alt text, adding this attribute is beneficial for several different reasons.

HTML

```
<html>
 <head>
<title></title>
</head>
<body>
<div id="header">
<p id="name">Deep Laxman Karki</p>
<a href="mailto:deepsukhwani@gmail.com" target="_blank"><p
id="email">deepsukhwani@gmail.com</p></a>
</div>
<div class="left">
</div>
<div class="right">
 <h3>CV Highlights</h3>
 <p>
 <ul>
<li>Currently going through CS253 - Web Application Engineering and
CS61A - Structure & Interpretation of Computer Programs</li>
<li>Learnt basic Python, JavaScript, HTML, CSS on Codecademy.com. </li>
<li>An independent, dedicated, efficient person. These attributes are proved
through the series of courses I have taken or I am taking as of now
independently through online platforms. </li>
<li>Good Communication Skills, Presentation Skills, attitude towards
leadership, authorisation and delegation, conflict resolution and negotiation
and a very good team worker.</li></ul>
 </p>
 <h3>Professional Experience</h3>
 <h4 id="company-name">Wingify Software Pvt Ltd</h4>
<pid="job-title"><strong>Support Engineer (Technical Support)</strong>
</p>
 <p id="job-responsibilities">Job Responsbilities</p>
 <p>
 <ul>
   <li>Answer customer queries over email / ticketing system</li>
<li>Interact with our engineering team to get software issues and bugs
resolved</li>
   <li>Occasionally interact with customers over Skype or telephone</li>
```

```
<li>Contribute ideas to the team on how customers can be
delighted</li></ul>
 </p>
 <h3>Educational Qualifications</h3>
 <table>
   <tr id="heading">
     <td>Qualification</td>
     <td>Board</td>
     <td>Percentage / Grades</td>
     <td>Year</td>
   </tr>
   <tr>
     <td>S.S.C</td>
     <td>B.Sc. CSIT</td>
     <td>85.57%</td>
     <td>2019</td>
   </tr>
   <tr>
     <td>H.S.C (Science Stream)</td>
     <td>TU Nepal</td>
     <td>72.40%</td>
     <td>2018</td>
   </tr>
   <tr>
     <td>GDCA (Grad. Dipl in Computer Applications)</td>
     <td>NIE (National Institute Of Engineering), Mumbai, India</td>
     <td>A Grade</td>
     <td>2008</td>
   </tr>
   <tr>
     <td>B.Sc. (Hons) - Applied Accounting</td>
     <td>Oxford Brookes University</td>
     <td>2:1 – Upper Second Class Honours</td>
     <td>2012</td>
   </tr>
   <tr>
     <td>Chartered Accounting - ACCA</td>
     <td>ACCA Glasgow, UK</td>
     <td>Passed (1st Attempt)</td>
     <td>2013</td>
   </tr>
 </table>
 <h3>Independent Courses</h3>
 <p>
 <ul>
   <li>
<span id="course-name">HTML & CSS for Beginners – Web
Fundamentals</span> – Codecademy.com</li>
   <li>
```

```
<span id="course-name">Python - Fundamentals and Dynamic Programming </span> - Codecademy.com</li>
  <li>
<span id="course-name">JavaScript - Programming Basics, JS Apps and Build Games </span> - Codecademy.com</li>
  <li>
<span id="course-name">CS101: Introduction to Computer Science - Building a Web Crawler</span> - Udacity.com</li>
  <li>
<span id="course-name">CS50x - Introduction to Computer Science I</span> - edX.org & Harvard University</li>
  <li>
<span id="course-name">Calculus One</span> - Ohio State University & Coursera.org </li>
  <li>
<span id="course-name">Introduction to Finance</span> - Coursera.org & University of Michigan</li>
 </ul>
 <h3>Technical Skills</h3>
 <p>
 <ul>
  <li>
<span id="course-name">Operating Systems:</span> DOS, Windows 98, Windows 2000, Windows XP, Windows NT, Windows Server 2003, Windows Vista, Windows 7, Macintosh Computers (OS X), Linux (Ubuntu, Fedora)</li>
  <li>
<span id="course-name">Application Software:</span> Office 97-2003; Office XP, Office 2007, Office for Mac 2011, iWork '09, Sage Accounting Software, Sage 50 (Accounting Software), Excel 2003/2007 for Financial Modelling spreadsheets.</li>
    <li>
<span id="course-name">Programming Skills:</span>HTML, CSS, Python, JavaScript, learning C and C++</li></ul>
 </p>
 <h3>Certifications / Awards:</h3>
 <p>
 <ul>
<li>Scored highest in ACCA P1 - Governance, Risk & Ethics exam - June 2012 session amongst full time international students at Kaplan Financial, London.</li>
<li>Interviewed by ACCA for "international ACCA student in UK", interview published in January 2012 edition of ACCA Student Accountant Magazine.</li>
<li>Interviewed by ACCA for "international ACCA student in UK", interview published in January 2012 edition of ACCA Student Accountant Magazine.</li></ul>
 </p>
 <h3>Personal Information :</h3>
```

```
<p>
<ul>
  <li>
A young, determined hard and smart working person. I believe in task based roles and complete ownership of work.
  <li>
<span id="course-name">Languages Known :</span>English, Hindi, Gujarati and Sindhi</li>
  <li>
<span id="course-name">Hobbies:</span>I love reading Finance and IT related books / magazines, playing Chess, swimming, listening music, surfing Internet, self-learning through e-courses.</li> </ul>
</p>
<h3>Other Information</h3>
<p>
<ul>
  <li>
  <span id="course-name">Expected Salary :</span>As per company standards</li>
  <li>
  <span id="course-name">Area of Interest:</span>Software Development, Programming, Start-ups, Coding, App Development, Technical Support, Support Engineer, Customer Happiness, Client service, Investment Banking, Corporate Finance, Hedge Funds, Mergers & Acquisitions, Analyst, Equity Research, Business Analysis</li>
<li>
<span id="course-name">Joining Date :</span>Immediate</li></ul>
</p>
<h3>Declaration</h3>
<p>
I hereby declare that the details furnished above are true and correct to the best of my knowledge and belief.</p>
</div>
<div id="footer"></div>
</body>
</html>
```

CSS

```
div
{
border-radius: 5px;
}
#header
{
position: fixed;
z-index: 1;
height:40px;
width: 98%;
background-color: #668284;
margin-bottom: 10px
}
```

```
    #name {
float:left;
    margin-left: 20px;
    padding-bottom: 10px;
    font-size: 16px;
    font-family: Verdana, sans-serif;
    color: #ffffff;
    }
    #email{
float:right;
margin-right: 20px;
    padding-bottom: 10px;
    font-size: 16px;
    font-family: Verdana, sans-serif;
    color: #ffffff;
    }
    #contact
    {
    margin-left:45%;
    padding-bottom: 10px;
    font-size: 16px;
    font-family: Verdana, sans-serif;
    color: #ffffff;
    }
    a:hover {
    font-weight: bold;
    }
    .right
    {
  float: left;
  margin-top: 50px;
  padding-left:5px;
  margin-left: 14%;*/
  height: auto;
  width: 99%;
  background-color: #E3EDD8;
  }
#footer
{
  height:40px;
  clear:both;
  position: relative;
  background-color: #C1E3E1;
  }
h3
{
  text-decoration: underline;
  }
#job-responsibilities
{
  padding: 1px;
  }
```

```
.job-title
{
  font-weight: bold;
  }
table
{
  border: 1px dashed black;
  }
td
{
  padding: 2px;
  border: 1px solid #E88741;
  }
#course-name
{
  font-weight:bold;
  }
#company-name
{
  height:2px;
  text-decoration:underline;
  }
#job-title
{
  height: 5px;
  }
.job-duration
{
  float:right;
  }
#heading
{
  font-weight:bold;
  }
```

10. Develop a simple web page that asks the users input (name, email, phone, gender) and store into database using server side script.

Ans:

```
<html>
<head>
<title>PHP User Registration Form</title>
<link href="./css/style.css" rel="stylesheet" type="text/css" />
</head>
<body>
<form name="frmRegistration" method="post" action="">
  <div class="demo-table">
  <div class="form-head">Sign Up</div>
   <?php
  if (! empty($errorMessage) && is_array($errorMessage))
  {?>
   <div class="error-message">
   <?php
```

```
foreach($errorMessage as $message)
{
  echo $message . "<br/>";
}
?>
</div>
<?php
}
?>
 <div class="field-column">
   <label>Username</label>
   <div>
     <input type="text" class="demo-input-box"
       name="userName"
  value="<?php  if(isset($_POST['userName'])) echo $_POST ['userName'];
?>">
   </div>
 </div>

 <div class="field-column">
   <label>Email</label>
   <div>
     <input type="text" class="demo-input-box"
       name="userEmail"
  value="<?php  if(isset($_POST['userEmail'])) echo $_POST ['userEmail'];
?>">
   </div>
 </div>
 <div class="field-column">
   <label>Phone</label>
 <div><input type="phone" class="demo-input-box" name="phone" value=""
 </div>
  </div>
  <div class="field-column">
    <label>Gender</label>
    <div>
      <input type="gender" class="demo-input-box"
        name="gender" value="">
    </div>
  </div>
  <div class="field-column">
    <div class="terms">
      <input type="checkbox" name="terms"> I accept terms
      and conditions
    </div>
    <div>
      <input type="submit"
        name="register-user" value="Register"
        class="btnRegister">
```

```
            </div>
          </div>
        </div>
      </form>
    </body>
    </html>
```

And the styles are,

```
body {
   font-family: Arial;
   color: #333;
   font-size: 0.95em;
}
.form-head {
   color: #191919;
   font-weight: normal;
   font-weight: 400;
   margin: 0;
   text-align: center;
   font-size: 1.8em;
}
.error-message {
   padding: 7px 10px;
   background: #fff1f2;
   border: #ffd5da 1px solid;
   color: #d6001c;
   border-radius: 4px;
   margin: 30px 0px 10px 0px;
}
.success-message {
   padding: 7px 10px;
   background: #cae0c4;
   border: #c3d0b5 1px solid;
   color: #027506;
   border-radius: 4px;
   margin: 30px 0px 10px 0px;
}
.demo-table {
   background: #ffffff;
   border-spacing: initial;
   margin: 15px auto;
   word-break: break-word;
   table-layout: auto;
   line-height: 1.8em;
   color: #333;
   border-radius: 4px;
   padding: 20px 40px;
   width: 380px;
   border: 1px solid;
   border-color: #e5e6e9 #dfe0e4 #d0d1d5;
}
```

```
.demo-table .label {
  color: #888888;
}
.demo-table .field-column {
  padding: 15px 0px;
}
.demo-input-box {
  padding: 13px;
  border: #CCC 1px solid;
  border-radius: 4px;
  width: 100%;
}
.btnRegister {
  padding: 13px;
  background-color: #5d9cec;
  color: #f5f7fa;
  cursor: pointer;
  border-radius: 4px;
  width: 100%;
  border: #5791da 1px solid;
  font-size: 1.1em;
}
.response-text {
  max-width: 380px;
  font-size: 1.5em;
  text-align: center;
  background: #fff3de;
  padding: 42px;
  border-radius: 3px;
  border: #f5e9d4 1px solid;
  font-family: arial;
  line-height: 34px;
  margin: 15px auto;
}
.terms {
  margin-bottom: 5px;
}
```

11. What are the rules for creating XML document? Write a XML code to store following information about student.

- Each student has a name, address, phone and website element.
- Address might appears multiple times
- Address has attribute named "type" with value permanent and temporary phone must be 10 digits.

Ans: Rules for creating XML document are listed below

- All xml must have a root element
- All tags must be closed
- All tags must be properly nested
- Tag names have strict limits
- Tag names are case sensitive
- Tag names cannot contain spaces
- Attribute values must appear within quotes

- White space is preserved
- Avoid html tags

XML code

Student.xml

```
<?xml version="1.0"?>
<student_info xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xsi:noNamespaceSchemaLocation="xsfile.xsd">
  <student>
    <name>Bhupendra</name>
    <address type="permanent">Doti-1</address>
    <address type="temporary">KTM-1</address>
    <phone>234</phone>
    <website>bhupendra.com</website>
  </student>
</student_info>
```

xsfile.xsd

```
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
<xs:element name="phone">
 <xs:simpleType>
  <xs:restriction base="xs:string">
   <xs:minLength value="10" />
  </xs:restriction>
 </xs:simpleType>
</xs:element>
</xs:schema>
```

TRIBHUVAN UNIVERSITY

Faculty of Humanities & Social Sciences

OFFICE OF THE DEAN

TU QUESTIONS-ANSWERS 2020

Bachelor in Computer Applications
Course Title: Web Technology
Code No: CACS 205
Semester: III

Full Marks: 60
Pass Marks: 24
Time: 3 hours

Candidates are required to answer the questions in their own words as far as possible.

Group A

Attempt all the questions. **[10x1 = 10]**

i. Which of the following is not a pair tag?
   a) <p> b) <i>
   c) <title> d) <img>

ii. When should you use a path along with file name of a picture is an IMG tag?
   a) path is optional and not necessary
   b) when the location of image file and html file are different
   c) when image file and html file both are on same location
   d) path is always necessary when inserting image

iii. Which CSS property will be used if we doesn't want to allow following div to left side of the element?
   a) margin b) clear
   c) float d) Padding

iv. The most prevalent to materialize XML documents is to utilize.....
   a) DTD b) HTML
   c) XSLT d) SOAP

v. .....are serious error that require attention but don't stop script to execute.
   a) Fatal errors b) Notice
   c) Warnings d) Error Report Level

vi. Which of the following explain colder nature?
   a) Nonvolatile b) Volatile
   c) Intranet d) transient

vii. Which one of the following is the very first task executed by a session enabled page?
   a) delete the previous session
   b) start a new session
   c) check whether a valid session exists
   d) handle the session

viii. Which of the following XPath expression select the parents of current node?
   a) . b) ..
   c) / d) //

ix. Which of the following statement is not true about XML schema?
   a) they are used to define the content and structure of data.
   b) they have their own syntax.
   c) they define a set of symbols and the relationships of those symbols.
   d) they are themselves xml documents.

x. DOM represents a web page in.....
   a) Hash table structure
   b) Tree structure
   c) Dynamic structure
   d) Recursive structure

Answer Key

i. (d)	ii. (b)	iii. (b)	iv. (c)	v. (a)	vi. (d)	vii. (c)	viii. (b)	ix. (b)	x. (b)

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. What is HTML 5? Explain characteristics of HTML 5.

Ans: HTML5 is the 5th version or update of HTML. This is the most advanced HTML programming. In this version lot of tags were added to make the designer's life easier.

HTML5 Features

The following are the features of HTML5 that make it a popular language for website development.

1. **Nav Tag:** The <nav> tag helps in defining a set of navigation links. It helps create a section of a website that contains navigation links (within the current document or to another document). A few examples of navigation links are the table of contents and indexes.

   Example of Nav Tag
```
<!DOCTYPE html>
<html>
<body>
  <h1>Example of HTML nav Tag</h1>
  <h2>Online Programming Courses</h2>
  <nav>
   <a href="#">HTML</a> |
   <a href="#">CSS</a> |
   <a href="#">JavaScript</a> |
   <a href="#">Python</a>
  </nav>
</body>
</html>
```

2. **Audio & Video Tags:** With Audio and Video tags, developers can embed videos or audio into their websites. For styling the video tag, developers can use CSS and CSS3.

   Example of the video tag in HTML
```
<!DOCTYPE html>
<html>
<body>
<video width="400px" height="300px" controls>
 <source src=" movie.mp4 " type="video/mp4">
</video>
</body>
</html>
```

3. **Header:** The <header> element in HTML5 contains introductory content. It can include a set of introductory or navigational support on a

website. Typically, the header element contains heading elements, logo or icons, a search form, author's information, etc.

Example of header element in HTML5

```
<!DOCTYPE html>
<html>
<body>
  <h1>Nsc Learning</h1>
  <h3> Find courses that are the best for your career </h3>
    <header>
    <a href=
"https://www.nsc.com/learning/technology-courses-certification-
training-ct139">
    Technology</a> |
    <a href=
"https://www.nsc.com/learning/data-science-courses-certification-
training-ct123">
    Data Science</a> |
    <a href=
"https://www.nsc.com/learning/management-courses-certification-
training-ct135">
    Management</a> |
    <a href=
"https://www.nsc.com/learning/articles/">
    Blog</a> |
  </header>
</body>
</html>
```

4. **Footer:** The <footer> tag defines the footer of a document or a section. Typically, the footer contains information related to the author, copyright, contact information, sitemap, related documents, back to top links, etc. There can be more than one footer element in one document.

   Example of the footer in HTML5

```
<!DOCTYPE html>
<html>
  <body>
      <footer>
      <p>Posted by: Deepali Sharma</p>
     <p>Contact information: <a href="mailto:deepali@example.com">
      deepali@example.com</a>.</p>
    </footer>
  </body>
</html>
```

5. **Figure and figcaption:** These elements help users to insert an image with its caption. The fig. caption tag is used to add a description for the image.

   Example of Figcaption

```
<!DOCTYPE html>
<html>
<body>
```

```
<figure>
  <img src="red tulips.jpg"
     alt="Red Tulips">
  <figcaption>Red Tulips in a Garden</figcaption>
</figure>
</body>
</html>
```

6. **Canvas Tag:** The canvas tag in HTML5 helps users draw graphics or images on the fly using JavaScript. We can use it for drawing paths, boxes, circles, adding images, etc. The canvas tag has two attributes: width and height for setting the width and height of the canvas.

   Example of canvas tag in HTML5

```
<! DOCTYPE html>
<html>
  <body>
    <canvas id="Canvas1" width="400" height="100" style="border: 2px
    solid ;">
    </canvas>
  </body>
</html>
```

7. **Mark:** The <mark> element highlights a particular text that is of special interest to the user in an HTML document.

   Example of the mark element

```
<! DOCTYPE html>
<html>
    <body>
      <p> Grow your skillset with <mark>Nsc Learning.</mark> Find
the <mark>best online courses</mark> and certifications in
management, technology, programming, and data science.</p>
    </body>
</html>
```

8. **Main Tag:** This tag defines the important content of the <body> of a document.

   Example of Main Tag

```
<! DOCTYPE html>
<html>
  <body>
    <header>
      <p>Header content</p>
    </header>
  <main>
  <p>Main Content</p>
  <h2>Nsc Learning</h2>
  <p> Find courses that are best for your career </p>
  </main>
  </body>
</html>
```

9. **Progress Tag:** The progress tag helps users check the progress of a task during the execution. Users will need to define the dynamically changing values of the progress bar with the scripts (JavaScript).
Example of progress tag in HTML5

```
<!DOCTYPE html>
<html>
 <body>
  <span>Loading:</span>
  <progress value="55" max="100"></progress>
 </body>
</html>
```

10. **Section Tag:** The <section> element defines specific sections and subsections in the document.
Example of Section in HTML5

```
<! DOCTYPE html>
<html>
  <body>
    <section>
      <h1>Section 1</h1>
<p>Section 1 content</p>
    </section>
    <section>
      <h1>Section 2</h1>
<p>Section 2 content</p>
    </section>
  </body>
</html>
```

3. **Write HTML tag to generate the following table.**

	Average		Red Eyes
Males	**1.5**	**0.004**	**45%**
Females	**1.4**	**0.006**	**47%**

Ans:

```
<! DOCTYPE html>
<html>
<style>
table, th, td {
 border:1px solid black;
}
</style>
<body>
<TABLE border="1">
<TR><TH rowspan="2"><TH colspan="2">Average
  <TH rowspan="2">Red<BR>Eyes
<TR><TH>Height<TH>Weight
<TR><TH>Males<TD>1.5<TD>0.004<TD>45%
<TR><TH>Females<TD>1.4<TD>0.006<TD>47%
</TABLE>
```

4. Design the following website's Menu with use of HTML list and appropriate CSS.

HOME | NEWS | CONTACT | ABOUT

Ans:
```
<! DOCTYPE html>
<html>
<head>
<style>
ul {
 List-style-type: none;
 margin: 0;
 padding: 0;
}
</style>
</head>
<body>
<p>in this example, we remove the bullets from the list, and its default
      padding and margin. </p>

<ul>
 <li><a href="#home">Home</a></li>
 <li><a href="#news">News</a></li>
 <li><a href="#contact">Contact</a></li>
 <li><a href="#about">About</a></li>
</ul>
</body>
</html>
```

5. Compare and contrast between block level and inline elements in HTML.

Ans: Block Elements

Block elements begin from a new line by default and cover space to its left and right as far as it can go. The height that it covers is equal to the content height. Also, it covers the whole horizontal space of its parent element.

Example

```
<div style="border: 1px solid black ;"> About Us </div>
```

Inline Elements

Inline elements never start from a new line and only cover the width according to the size of bounded tags in the HTML element.

Example

```
<! DOCTYPE html>
<html>
 <body>
  <p>Hello, <span style="border: 1px solid black">Long time no
     see</span>.</p>
  <p>Inline element example</p>
 </body>
</html>
```

6. What is CSS Selector? Explain different types of selector with suitable example.

Ans: A CSS selector selects the HTML element for styling purpose. CSS selectors select HTML elements according to its id, class, type, attribute etc.

There are many basic different types of selectors.

- Element Selector
- Id Selector
- Class Selector
- Universal Selector
- Group Selector
- Attribute Selector

1. **Element selector:** The element selector selects HTML elements based on the element name (or tag) for example p, h1, div, span, etc.
   style.css: The following code is used in the above HTML code. You can see the CSS rules applied to all <p> tags and <h1> tags.

```
h1 {
  color: red;
  font-size: 3rem;
}
p {
  color: white;
  background-color: gray;
}
```

2. **Id selector:** The id selector uses the id attribute of an HTML element to select a specific element.
   style.css: The following code is used in the above HTML code using id selector.

```
#div-container{
  color: blue;
  background-color: gray;
}
```

3. **Class-selector:** The class selector selects HTML elements with a specific class attribute.
   style.css: The following code is used in the above HTML code using the class selector. To use class selector you must use (.) followed by class name in CSS. This rule will be applied to the HTML element with the class attribute "paragraph-class"

```
.paragraph-class {
  color:white;
  font-family: monospace;
  background-color: purple;
}
```

4. **Universal-selector:** The Universal selector (*) in CSS is used to select all the elements in a HTML document. It also includes other elements which are inside under another element.
   style.css: The following code is used in the above HTML code using the universal selector. This CSS rule will be applied to each and every HTML element on the page:

```
* {
 color: white;
 background-color: black;
}
```

5. **Group-selector**: This selector is used to style all comma separated elements with the same style.
style.css: The following code is used in the above HTML code using the group selector. Suppose you want to apply common styles to different selectors, instead of writing rules separately you can write them in groups as shown below.

```
#div-container, .paragraph-class, h1{
  color: white;
  background-color: purple;
  font-family: monospace;
}
```

6. **Attribute Selector:** The attribute selector [attribute] is used to select the elements with a specified attribute or attribute value.
style.css: The following code is used in the above HTML code using the attribute selector. This CSS rule will applied to each and every HTML element on the page:

```
[href] {Background-color: lightgreen;
  color: black;
  font-family: monospace;
  font-size: 1rem;
  }
```

All CSS Simple Selectors

Selector	Example	Example description
#id	#firstname	Selects the element with id="firstname"
.class	.intro	Selects all elements with class="intro"
element.class	p.intro	Selects only <p> elements with class="intro"
*	*	Selects all elements
element	p	Selects all <p> elements
element,element,..	div, p	Selects all elements and all <p> elements

7. **Why session is required in web development? Explain how you set and remove values stored in Session with suitable example?**

Ans: A session is a way to store information (in variables) to be used across multiple pages. Unlike a cookie, the information is not stored on the user's computer rather session is stored in server.
When you work with an application, you open it, do some changes, and then you close it. This is much like a Session. The computer knows who you are. It knows when you start the application and when you end. But on the internet there is one problem: the web server does not know who you are or what you do, because the HTTP address doesn't maintain state. Session variables solve this problem by storing user information to be used across multiple pages (e.g. username, favorite color, etc.). By default, session variables last until the user closes the browser. So; Session variables hold information about one single user, and are available to all pages in one application.

Uses of session

- Carrying information as a client travels between pages.
- One page data can be stored in session variable and that data can be accessed from other pages.

- Session can help to uniquely identify each client from another
- Session is mostly used in ecommerce sites where there is shopping cart system.
- It helps maintain user state and data all over the application.
- It is easy to implement and we can store any kind of object.
- Stores client data separately.
- Session is secure and transparent from the user.

Example:

Start a PHP session

PHP session_start() function is used to start the session. It starts a new or resumes existing session. It returns existing session if session is created already. If session is not available, it creates and returns new session.

E.g.

```
<?php
// Start the session
session_start();
?>
<!DOCTYPE html>
<html>
<body>
<?php
// Set session variables
$_SESSION["favcolor"] = "green";
$_SESSION["favanimal"] = "cat";
echo "Session variables are set.";
?>
</body>
</html>
```

GET PHP session variables values

```
<?php
session_start();
?>
<!DOCTYPE html>
<html>
<body>
<?php
// Echo session variables that were set on previous example
echo "Favorite color is " . $_SESSION["favcolor"] . ".<br>";
echo "Favorite animal is " . $_SESSION["favanimal"] . ".";
?>
</body>
</html>
```

8. **Critically analysis the pitfall of the 3-tier technology in comparison with n-tier technology.**

Ans: **3-Tier Architecture**

In 3-tier architecture, there is an intermediary level, meaning the architecture is generally split up between:

A client, i.e. the computer, which requests the resources, equipped with a user interface (usually a web browser) for presentation purposes

The application server (also called middleware), whose task it is to provide the requested resources, but by calling on another server
The data server, which provides the application server with the data it requires.

N-Tier Architecture (multi-tier)

N-tier architecture (with N more than 3) is really 3 tier architectures in which the middle tier is split up into new tiers. The application tier is broken down into separate parts. These parts are differs from system to system. The primary advantage of N-tier architectures is that they make load balancing possible. Since the application logic is distributed between several servers, processing can then be more evenly distributed among those servers. N-tiered architectures are also more easily scalable, since only servers experiencing high demand, such as the application server, need be upgraded. The primary disadvantage of N-tier architectures is that it is also more difficult to program and test an N-tier architecture due to its increased complexity.

Disadvantages of Three-Tier Architecture:

- It is more complex than the 2-tier client-server computing model, because it is more difficult to build a 3-tier application compared to a 2-tier application. The points of communication are doubled.
- The client does not maintain a persistent database connection.
- A separate proxy server may be required.
- Network traffic will be increased if a separate proxy server is used.
- The physical separation of application servers containing business logic functions and database servers containing databases may be something that affects performance.
- Improve complexity or effort.

Group C

Attempt any TWO questions. **[2 × 10 = 20]**

9. Design the following layout of webpage with use of div and appropriate CSS **[10]**

Log	
Navigation	
Header Banner	
Side Bar	**Body Area**
Footer	

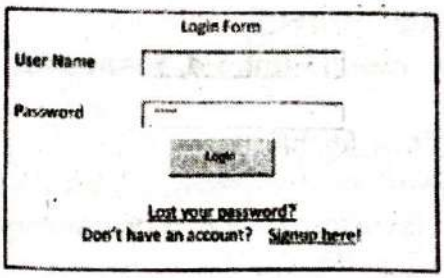
Ans:
```
<!DOCTYPE html>
<html>
<head>
<style>
*{
 box-sizing: border-box;
}
body {
 font-family: Arial;
 padding: 10px;
 background: #f1f1f1;
}
```

```
/* Header/Blog Title */
.header {
 padding: 30px;
 text-align: center;
 background: white;
}
.header h1 {
 font-size: 50px;
}
/* Style the top navigation bar */
.topnav {
 overflow: hidden;
 background-color: #333;
}
/* Style the topnav links */
.topnav a {
 float: left;
 display: block;
 color: #f2f2f2;
 text-align: center;
 padding: 14px 16px;
 text-decoration: none;
}
/* Change color on hover */
.topnav a:hover {
 background-color: #ddd;
 color: black;
}
/* create two unequal columns that floats next to each other */
/* Left column */
.leftcolumn {
 float: left;
 width: 75%;
}
/* Right column */
.rightcolumn {
 float: left;
 width: 25%;
 background-color: #f1f1f1;
 padding-left: 20px;
}
/* Fake image */
.fakeimg {
 background-color: #aaa;
 width: 100%;
 padding: 20px;
}
```

```
    /* Add a card effect for articles */
    .card {
      background-color: white;
      padding: 20px;
      margin-top: 20px;
    }
    /* Clear floats after the columns */
    .row:after {
      content: "";
      display: table;
      clear: both;
    }
    /* Footer */
    .footer {
      padding: 20px;
      text-align: center;
      background: #ddd;
      margin-top: 20px;
    }
    @media screen and (max-width: 800px) {
      .leftcolumn, .rightcolumn {
        width: 100%;
        padding: 0;
      }
    }
    @media screen and (max-width: 400px) {
      .topnav a {
        float: none;
        width: 100%;
      }
    }
  </style>
  </head>
  <body>
  <div class="header">
    <h1>My Website</h1>
    <p>Resize the browser window to see the effect. </p>
  </div>
  <div class="topnav">
    <a href="#">Link</a>
    <a href="#">Link</a>
    <a href="#">Link</a>
    <a href="#" style="float:right">Link</a>
  </div>
  <div class="row">
    <div class="leftcolumn">
      <div class="card">
```

```
    <h2>TITLE HEADING</h2>
    <h5>Title description, Dec 7, 2022</h5>
    <div class="fakeimg" style="height: 200px ;"> Image</div>
    <p>Some text..</p>
   </div>
   <div class="card">
    <h2>TITLE HEADING</h2>
    <h5>Title description, Sep 2, 2022</h5>
    <div class="fakeimg" style="height: 200px ;"> Image</div>
    <p>Some text..</p>
    </div>
  </div>
  <div class="rightcolumn">
   <div class="card">
    <h2>About Me</h2>
    <div class="fakeimg" style="height: 100px ;"> Image</div>
     </div>
   <div class="card">
    <h3>Popular Post</h3>
    <div class="fakeimg"><p>Image</p></div>
    <div class="fakeimg"><p>Image</p></div>
    <div class="fakeimg"><p>Image</p></div>
   </div>
   <div class="card">
    <h3>Follow Me</h3>
    <p>Some text..</p>
   </div>
  </div>
 </div>
 <div class="footer">
  <h2>Footer</h2>
 </div>
 </body>
 </html>
```

10. Write a server-site script for login process assume that user name and password have already exist on database TU under the user table (id, user, password) **[10]**



Ans:

```
<? php
// Initialize the session
session_start();
if(isset($_SESSION["loggedin"]) && $_SESSION["loggedin"] === true){
   header("location: welcome.php");
```

```
    exit;
}
 // include config file
require_once "config.php";
 // define variables and initialize with empty values
$username = $password = "";
$username_err = $password_err = $login_err = "";
 // processing form data when form is submitted
if ($_SERVER["REQUEST_METHOD"] == "POST"){
    // Check if username is empty
   if (empty(trim($_POST["username"]))){
      $username_err = "Please enter username.";
   } else {
      $username = trim ($_POST ["username"]);
   }
   // Check if password is empty
   if (empty(trim($_POST["password"]))){
      $password_err = "Please enter your password.";
   } else {
      $password = trim ($_POST ["password"]);
   }
      // validate credentials
   if (empty($username_err) && empty($password_err)){
      // prepare a select statement
 $sql = "SELECT id, username, password FROM users WHERE username
=?";
         if ($stmt = mysqli_prepare($link, $sql)){
         // Bind variables to the prepared statement as parameters
         mysqli_stmt_bind_param($stmt, "s", $param_username);
         // Set parameters
         $param_username = $username;
         // Attempt to execute the prepared statement
         if (mysqli_stmt_execute($stmt)){
            // Store result
            mysqli_stmt_store_result($stmt);
            // Check if username exists, if yes then verify password
            if (mysqli_stmt_num_rows($stmt) == 1){
               // Bind result variables
      mysqli_stmt_bind_result($stmt, $id, $username,
$hashed_password);
               if (mysqli_stmt_fetch($stmt)){
                  if (password_verify($password, $hashed_password)){
            // Password is correct, so start a new session
                     session_start();
            // Store data in session variables
                     $_SESSION ["loggedin"] = true;
                     $_SESSION ["id"] = $id;
                     $_SESSION ["username"] = $username;
                  // Redirect user to welcome page
```

```
                header ("location: welcome.php");
            } else {
                // Password is not valid, display a generic error message
                $login_err = "Invalid username or password.";
            }
        }
    } else {
        // Username doesn't exist, display a generic error message
        $login_err = "Invalid username or password.";
    }
} else {
    echo "Oops! Something went wrong. Please try again later.";
}
// Close statement
mysqli_stmt_close($stmt);
}
}
// Close connection
mysqli_close($link);
}
?>
<! DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>Login</title>
  <link rel="stylesheet"
href="https://stackpath.bootstrapcdn.com/bootstrap/4.5.2/css/bootstrap.
min.css">
  <style>
    body{ font: 14px sans-serif; }
    .wrapper{ width: 360px; padding: 20px; }
  </style>
</head>
<body>
  <div class="wrapper">
    <h2>Login</h2>
    <p>Please fill in your credentials to login. </p>
    <?php
    if(!empty($login_err)){
        echo '<div class="alert alert-danger">' . $login_err . '</div>';
    }
    ?>
<form action="<?php echo htmlspecialchars($_SERVER["PHP_SELF"]); ?>"
method="post">
        <div class="form-group">
          <label>Username</label>
```

```
            <input type="text" name="username" class="form-control <?php
echo (!empty($username_err)) ? 'is-invalid': '' ;?>" value="<?php echo
$username; ?>">
            <span class="invalid-feedback"><?php echo $username_err;
?></span>
        </div>
        <div class="form-group">
          <label>Password</label>
            <input type="password" name="password" class="form-control
<?php echo (!empty($password_err)) ? 'is-invalid': '' ;?>">
            <span class="invalid-feedback"><?php echo $password_err;
?></span>
        </div>
        <div class="form-group">
          <input type="submit" class="btn btn-primary" value="Login">
        </div>
        <p>don't have an account? <a href="register.php">Sign up
now</a>.</p>
      </form>
    </div>
</body>
</html>
```

11. What are the rules for Well-formed xml document? Create a sample well-formed xml and validate it with DTD Schema.

Ans: The XML Syntax rules for Well-formed XML include:

- All XML elements must have a closing tag.
- XML tags are case-sensitive.
- All XML elements must be properly nested.
- All XML documents must have a root element.
- Attribute values must always be quoted.
- With XML, whitespace is preserved

The Namespace-well-formed rules include:

- All element and attribute names contain either zero or one colon.
- No entity names, processing instruction targets, or notation names contain any colons

Building XML Document

In HTML, we have to use predefined tags like <html></html> or <body></body> for interpreting our data on the web. But, when using XML, user-defined tags can be created easily, and we use them to transport information between webpages.

```
<?xml version="1.0"?>
<customer>
 <firstname>Sohan</firstname>
 <lastname>Bhatt</lastname>
 <companyname>Section</companyname>
 <email>sohan@section.io</email>
 <message>Welcome message</message>
</customer>
```

Validating using DTD

There are two types of DTD validations: Internal validation and External validation.

For internal validations, we will write the whole DTD in the same file as the XML file, which can be used for validation.

Similarly, the external validation will validate the XML based on the DTD written in a separate file with the .dtd extension.

If it's an Internal DTD validation, it shows the whole XML code with its DTD validation below:

```
<?xml version="1.0" encoding="utf-8"?>
<!DOCTYPE customer [
<!ELEMENT customer (firstname, lastname, companyname, email, message)>
<!ELEMENT firstname (#PCDATA)>
<!ELEMENT lastname (#PCDATA)>
<!ELEMENT companyname (#PCDATA)>
<!ELEMENT email (#PCDATA)>
<!ELEMENT message (#PCDATA)>
]>
<customer>
 <firstname>Sohan</firstname>
 <lastname>Bhatt</lastname>
 <companyname>Section</companyname>
 <email>sohan@section.io</email>
 <message>Welcome message</message>
</customer>
```

If it's an External DTD validation, it can store the DTD code in a file called validation.dtd.

```
<!ELEMENT customer (firstname, lastname, companyname, email, message)>
<!ELEMENT firstname (#PCDATA)>
<!ELEMENT lastname (#PCDATA)>
<!ELEMENT companyname (#PCDATA)>
<!ELEMENT email (#PCDATA)>
<!ELEMENT message (#PCDATA)>
```

And now the DTD file can be referenced in XML as shown below:

```
<?xml version="1.0" encoding="utf-8"?>
<!DOCTYPE customer SYSTEM "validation.dtd">
<customer>
 <firstname>Sohan</firstname>
 <lastname>Bhatt</lastname>
 <companyname>Section</companyname>
 <email>sohan@section.io</email>
 <message>Welcome message</message>
</customer>
```

In both types of validations, DTD does the parsing based on the structure that defines the XML file.

MODEL QUESTIONS SETS FOR PRACTICE

MODEL SET 1

Bachelor in Computer Applications
Course Title: Web Technology
Code No: CACS 205
Semester: III

Full Marks: 60
Pass Marks: 24
Time: 3 hours

Candidates are required to answer the questions in their own words as far as possible.

Group A

Attempt all the questions. **[10x1 = 10]**

1. Circle (O) the correct answer.

i. HTML stands for?
   a) Hyper Text Markup Language b) High Text Markup Language
   c) Hyper Tabular Markup Language d) None of these

ii. attribute of <form> tag
   a) Method b) Action
   c) Both (a) & (b) d) None of these

iii. White spaces in XML includes
   a) Things like space characters, new lines and tabs
   b) Only spaces
   c) Space between two double quotes
   d) None of these

iv. XPATH used to.....
   a) Address your documents by specifying a location path
   b) Address the server
   c) Store the IP address of the server
   d) None of these

v. **DTD's are.....**
   a) Ways to create templates for out does type
   b) Document type declaration in XML
   c) Part of Name spaces
   d) None of these

vi. The words Document Node, Node list, Element Node, Named Node Map etc. are
   a) Interfaces b) Objects
   c) Attributes d) Elements

vii. Which of the following creates push button?
   a) CHECK BOX b) RADIO
   c) RESET d) INPUT

viii. Scheme is.....
   a) template written in XML and can be modified at runtime
   b) read only for all practical purposes
   c) a global name space
   d) None of these

ix. A much better approach to establish the base URL is to use.....
a) BASE element
b) HEAD element
c) both (a) and (b)
d) none of these

x. XSL is.....
a) an XML based language to create style sheets
b) a language which is not used in XML
c) extensible solution language
d) extended style sheet language

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. Create a DTD to display daily schedule of user.
3. Write XML Schema for library information system.
4. Discuss the various terms related to Document Type Definition.
5. How the result set of MySQL is handled in PHP?
6. Describe different popup boxes supported by java script briefly. Write a sample program to show use these popup boxes.
7. Create
8. Define frame. Create a HTML page that displays multiple frames in a window.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. 'JavaScript is referred to as Object based programming language'. Justify with an example.
10. Which java script operator calculates the remainder by dividing two integers? Explain with example
11. What is client/server technology? Differentiate between web client and web server.

MODEL SET 2

Group A

Attempt all the questions. **[10x1 = 10]**

1. Circle (O) the correct answer.

i. How DOM differs from SAX?
a) DOM is not event driven and builds up the whole memory
b) SAX is event driven and requires less space
c) DOM and SAX are packages
d) None of these

ii. Namespace.....
a) distinguishes one XML vocabulary from another
b) provides the spaces in the names
c) is a querying language
d) none of these

iii. Document type declaration and document type definition are
a) different terms
b) same
c) uncertain
d) can't say

iv. Correct HTML tag for the largest heading is
a) <head>
b) <h6>
c) <heading>
d) <h1>

v. Markup tags tell the web browser
   a) How to organize the page
   b) How to display the page
   c) How to display message box on page
   d) None of these

vi. www is based on which model?
   a) Local-server
   b) Client-server
   c) 3-tier
   d) None of these

vii. What are Empty elements and is it valid?
   a) No, there is no such term as Empty Element
   b) Empty elements are element with no data
   c) No, it is not valid to use Empty Element
   d) None of these

viii. Which of the following is a container?
   a) <SELECT>
   b) <BODY>
   c) <INPUT>
   d) Both (a) and (b)

ix. The attribute, which define the relationship between current document and HREF'ed URL is.....
   a) REL
   b) URL
   c) REV
   d) all of these

x. Character encoding is.....
   a) method used to represent numbers in a character
   b) method used to represent character in a number
   c) a system that consists of a code which pairs each character with a pattern, sequence of natural numbers or electrical pulse in order to transmit the data
   d) none of these

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. Describe the scoping rules for the Java script.
3. Create a HTML which uses CSS that gives all H1 and H2 elements a padding of 0.5 ems; a grooved border style and a margin of 0.5 ems.
4. Write a short note on creating tables in HTML.
5. Write a short note on JavaScript DOM.
6. Differentiate between SMTP and POP.
7. Why CSS are important in web designing? Describe the use of id and class selectors with suitable example.
8. Write the JAVA script to print "Good-Day" using IF-ELSE condition.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. Why XSD is used? How it is different from DTD? Write XSD and DTD for Book, where book contains author, publication, Title, price and pages. Further Author contains First Name, Last Name, and Education in order and can occur 4 times maximum and 1 times minimum. Define root element of your own interest
10. What are two methods of validating the forms? Highlight their good and bad points. Prepare a form containing the controls Name, Phone, and Email. Validate the form such that Name field contains only text, Phone field contains only digits, and Email field contains valid email id.
11. Explain 2-tier, 3-tier and n-tier client server architecture.

MODEL SET 3

Group A

Attempt all the questions. **[10x1 = 10]**

1. **Circle (O) the correct answer.**

i. From which tag the descriptive list starts?
   a) <LL> b) <DD>
   c) <DL> d) <DS>

ii. Correct HTML to left align the content inside a table cell is
   a) <tdleft> b) <td raligh = "left" >
   c) <td align = "left"> d) <td leftalign>

iii. How can you open a link in a new browser window?
   a) < a href = "url" target = "new"> b) <a href = "url" target= "_blank">
   c) <a href = "url".new> d) <a href = "url" target ="open">

iv. Who is making the Web standards?
   a) Mozilla b) Microsoft
   c) The World Wide Web consortium d) Nvdia

v. Can the element <First> be replaced with <first>
   a) No, they represent different elements altogether
   b) Both are same
   c) First is correct only
   d) First is only correct

vi. Which of the tag is used to create a number list?
   a) <LI> b. <OL>
   c) <LI> and <OL> d. None of these

vii. Document type declaration and document type definition are
   a) different terms b) same
   c) uncertain d) can't say

viii. XSLT is.....
   a) an extended style sheet language is used for formatting
   b) an extensible style sheet language and is used for formatting
   c) used for session tracking in XML
   d) none of these

ix. What is XML?
   a) Subset of SGML, Extensible Markup Language
   b) Superset of SGML, Extendable Markup Language
   c) Like SGML, Extended Markup Language
   d) None of these

x. A document has how many DTD's?
   a) Two b) None
   c) Three d) All of these

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. When the namespace is called in XML? Why?
3. Differentiate between 'Get' and 'Post' methods in PHP.
4. What is JavaScript? How it is different from server side scripting languages? Discuss uses of JavaScript briefly.

5. What are the drawbacks of HTML? How are they addressed in XML?
6. Elaborate Internet addressing and types of Internet connections.
7. Explain the concept of Exception Handing. How will you create your own exception?
8. What is the use of XML namespaces? Explain with suitable example.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. What is cookie? Explain the methods of setting and reading cookies using java script.
10. Explain 2-tier, 3-tier and n-tier client server architecture.
11. Write a XML document for storing records of 5 employees with ID, Name, Salary and Age. Create a XSLT file to display the record of employees having salary more than 20000.

MODEL SET 4

Group A

Attempt all the questions. **[10x1 = 10]**

1. **Circle (O) the correct answer.**

i. Which of these is a client server application?
   a) Web browsing b) E-mail
   c) Internet chat d) All of the above

ii. <INPUT> is.....
   a) format tag b) empty tag
   c) both (a) and (b) d) none of these

iii. What is the correct HTML for adding a background color?
   a) <background>yellow<Background>
   b) <body color = "yellow">
   c) <body bg color = "yellow">
   d) <body bg ="yellow">

iv. Main container for <TR>, <TD> and <TH> is
   a) <TABLE> b) <GROUP>
   c) <DATA> d) All of these

v. Which of the following selector selects the elements that are checked?
   a) E ~ F b) ::after
   c) :checked d) none of the mentioned

vi. Document Object Model (DOM) is a
   a) a parser b) specification
   c) coding style d) none of these

vii. Node in XML is.....
   a) any part of the document whether it is elements, attribute or otherwise
   b) referred only to the attributes
   c) referred to the top element in the document
   d) none of these

viii. Well formed XML
   a) meets certain grammatical rules outlined in the XML 1.0 specification
   b) doesn't contain DTD's
   c) is full of formula's
   d) none of these

ix. XPATH used to
   a) Address your documents by specifying a location path
   b) Address the server
   c) Store the IP address of the server
   d) None of these

x. Which of the following statements are true?
   a) Http runs over TCP
   b) Http allows information to be stored in a URL
   c) Http can be used to test the validity of a hypertext link
   d) All of the above

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. Write XML Schema for library information system.
3. Discuss the various terms related to Document Type Definition.
4. How the result set of MySQL is handled in PHP?
5. Describe different popup boxes supported by java script briefly. Write a sample program to show use these popup boxes.
6. Create a HTML form with five basic features.
7. Write about the various Objects used in Java script.
8. Define frame. Create a HTML page that displays multiple frames in a window.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. What is Document object model? Discuss the various DOM methods used with java script.
10. What are the benefits of using styles compared with placing formatting directly into the text of the Web page?
11. Write a script that reads an integer and determines whether it is PRIME Number or Not.

MODEL SET 5

Group A

Attempt all the questions. **[10x1 = 10]**

1. **Circle (O) the correct answer.**

i. HTML is what type of language?
   a) Scripting Language b) Markup Language
   c) Programming Language d) Network Protocol

ii. Fundamental HTML Block is known as _____.
   a) HTML Body b) HTML Tag
   c) HTML Attribute d) HTML Element

iii. What should be the first tag in any HTML document?
   a) <head> b) <title>
   c) <html> d) <document>

iv. What tag is used to display a picture in a HTML page?
   a) picture b) image
   c) img d) src

v. Which of the following is true about Web services?
   a) Web services are open standard (xml, soap, http etc.) based web applications.
   b) Web services interact with other web applications for the purpose of exchanging data.
   c) Web services can convert your existing applications into web-applications.
   d) All of the above.

vi. How request is sent in XML-RPC?
   a) Requests are encoded in xml and sent via http post.
   b) Requests are encoded in xml and sent via http get.
   c) Both of the above.
   d) None of the above.

vii. Which of the following is correct about SOAP?
   a) Soap is an xml-based protocol for exchanging information between computers.
   b) Soap is a communication protocol.
   c) Soap is for communication between applications.
   d) All of the above.

viii. The attribute, which define the relationship between current document and HREF'ed URL is.....
   a) Rel
   b) Url
   c) Rev
   d) None of the above

ix. HTML web pages can be read and rendered by _____.
   a) Compiler
   b) Server
   c) Web Browser
   d) Interpreter

x. XPATH used to.....
   a) Address your documents by specifying a location path
   b) Address the server
   c) Store the IP address of the server
   d) None of these

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. Explain how basic and nested tables are created using HTML
3. Explain the various types of XML schema data types used.
4. What is HTTP? Discuss its function in detail.
5. Explain the four possible keywords in a DTD declaration with suitable examples.
6. Describe the use of id and class selectors with suitable example.
7. What is FTP? Explain their working mechanism.
8. What are the benefits of using styles compared with placing formatting directly into the text of the Web page?

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. Compare XML schema with DTD. Why do we need XSLT? Explain XSL element.
10. Discuss SMTP. What is HTTP? Discuss its function in detail.
11. Develop a simple website that asks the users to register using user name, password and email address. Store these information's in a database. Use client side script to validate the user input during registrations.

MODEL SET 6

Group A

Attempt all the questions. **[10x1 = 10]**

1. **Circle (O) the correct answer.**

i. How can you make a numbered list?
   a) <dl> b) <ol>
   c) <list> d) <ul>

ii. A script is a.....
   a) Program or sequence of instructions that is interpreted or carried out by processor directly
   b) Program or sequence of instruction that is interpreted or carried out by another program
   c) Program or sequence of instruction that is interpreted or carried out by web server only
   d) None of above

iii. When compared to the compiled program, scripts run
   a) Faster b) Slower
   c) The execution speed is similar d) Depend on the script

iv. Which component of JDOM Parser represents DOM tree?
   a) Document b) Element
   c) Attribute d) Text

v. Which of the following is the correct syntax to print a page using JavaScript?
   a) Window.print(); b) Browser.print();
   c) Navigator.print(); d) Document.print();

vi. Which of the following type of variable is visible only within a function where it is defined?
   a) Global variable b) Local variable
   c) Both of the above. d) None of the above.

vii. A piece of icon or image on a web page associated with another webpage is called
   a) Url b) Hyperlink
   c) Plugin d) None of the mentioned

viii. What is a web browser?
   a) A program that can display a web page
   b) A program used to view html documents
   c) It enables user to access the resources of internet
   d) All of the mentioned

ix. Common gateway interface is used to
   a) Generate executable files from web content by web server
   b) Generate web pages
   c) Stream videos
   d) None of the mentioned

x. URL stands for.....
   a) Unique reference label b. Uniform reference label
   c) Uniform resource locator d. Unique resource locator

Group B

[6x5 = 30]

Attempt any SIX questions.

2. What is the structure of HTML file? Explain with example.
3. Define CSS? How can you use an external CSS? Explain.
4. Discuss the use of Cookies with suitable example.
5. What is web server software? Discuss its role on the internet.
6. Write server-side code to select data stored in the database.
7. Discuss integrated window authentication.
8. How can you define event handler? Write a java script to demonstrate event handling.

Group C

[2x10 = 20]

Attempt any TWO questions.

9. Explain the use of XML in web development. Write internal and external DTD to describe "mail" as a root element and "to", "From", and "Subject" and "Message" as child elements.
10. Explain the architectural issues of web layer with example.
11. Develop a simple web site that takes first name, last name, and address from the user and store this information in the database. Use java script to validate form data.

MODEL SET 7

Group A

Attempt all the questions. [10x1 = 10]

1. Circle (O) the correct answer.

i. Which of the following options is correct with regard to HTML?
   a) It is a modeling language
   b) It is a dtp language
   c) It is a partial programming language
   d) It is used to structure documents

ii. HTML is considered as _____ language.
   a) Higher level language
   b) Markup language
   c) OOP language
   d) Programming language

iii. HTML markup language is a set of Markup _____.
   a) Tags
   b) Attributes
   c) Groups
   d) Sets

iv. Which attribute is used to name an element uniquely?
   a) Class
   b) Id
   c) Dot
   d) All of above

v. What DOM stands for?
   a) Direct object model
   b) Document object modeling
   c) Document object model
   d) Document output model

vi. Which of the following is true about XPath?
   a) Xpath is an official recommendation of the World Wide Web consortium (w3c).
   b) It defines a language to find information in an xml file.
   c) Both of the above.
   d) None of the above.

vii. Which of the following statements is not true about XML Schemas:
a) They are used to define the content and structure of data.
b) They define a set of symbols and the relationships of those symbols.
c) They are themselves xml documents.
d) They have their own syntax.

viii. In HTTP, a _____ server is a computer that keeps copies of responses to recent requests.
a) Regular
b) Proxy
c) Both a and b
d) None of the above

ix. Which of the following is the correct syntax to redirect a url using JavaScript?
a) document.location='http://www.newlocation.com';
b) browser.location='http://www.newlocation.com';
c) navigator.location='http://www.newlocation.com';
d) window.location='http://www.newlocation.com';

x. Web-applications were developed in order to interact _____.
a) Different platforms
b) Server
c) Browsers
d) None of these

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. Create a DTD to display daily schedule of user.
3. Write XML Schema for library information system.
4. Discuss the various terms related to Document Type Definition.
5. How the result set of MySQL is handled in PHP?
6. Describe different popup boxes supported by java script briefly. Write a sample program to show use these popup boxes.
7. What types of primary data structures are supported in Perl? Discuss
8. Define frame. Create a HTML page that displays multiple frames in a window.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. What is Document object model? Discuss the various DOM methods used with java script.
10. What are the benefits of using styles compared with placing formatting directly into the text of the Web page?
11. Write a script that reads an integer and determines whether it is PRIME Number or Not.

MODEL SET 8

Group A

Attempt all the questions. **[10x1 = 10]**

1. Circle (O) the correct answer.

i. Which of the following layer in Web Service Protocol Stack is responsible for describing the public interface to a specific web service?
a) Service transport
b) Xml messaging
c) Service description
d) Service discovery

ii. HTTP uses the services of _____ on well-known port 80.
a) UDP
b) IP
c) TCP
d) none of the above

iii. Which of the following is true about variable naming conventions in JavaScript?
a) You should not use any of the JavaScript reserved keyword as variable name.
b) JavaScript variable names should not start with a numeral (0-9).
c) Both of the above.
d) None of the above.

iv. A web cookie is a small piece of data
a) sent from a website and stored in user's web browser while a user is browsing a website
b) sent from user and stored in the server while a user is browsing a website
c) sent from root server to all servers
d) none of the mentioned

v. An alternative of JavaScript on windows platform is.....
a) Vbscript
b) Asp.net
c) Jsp
d) None of the mentioned

vi. Which element contains the Head and Body elements inside it?
a) <!Doctype>
b) <html>
c) <living being>
d) None of above

vii. Which of the following is not an element in HTML document?
a) <!Doctype>
b) <html>
c) <head>
d) <body>

viii. Head and Body elements are nested inside which element?
a) DOCTYPE
b) HTML
c) HEAD
d) ALL OF ABOVE

ix. Which of the following creates push button?
a) CHECK BOX
b) RADIO
c) RESET
d) INPUT

Group B

Attempt any SIX questions. **[6x5 = 30]**

2. Explain how basic and nested tables are created using HTML
3. Explain the various types of XML schema data types used.
4. Show how SAX is an alternative method for parsing XML documents. Write its advantages.
5. Explain the four possible keywords in a DTD declaration with suitable examples.
6. Discuss how the XMLHttpRequest can be cancelled in AJAX.
7. Explain with an example program how to connect to a SQL Server database from a PHP script.
8. Describe the use of id and class selectors with suitable example.

Group C

Attempt any TWO questions. **[2x10 = 20]**

9. Develop a simple website that asks the users to register using username, password, and email address. Store these information's in a database. Use client side script to validate the user input during registration.
10. What is XML? Discuss the structure of XML file with example. Write an XML schema to describe "address" as an element and "city, state, street and house-no" as its attributes.
11. What is HTTP? Discuss its function in detail.

□□□

Probability & Statistics

Course Code: CACT202 **Year/Semester: II/III**
Course Title: Probability & Statistics (3 Cr.) **Class Load: 5 Hrs. I Week**
(Theory: 3 Hrs., **Tutorial:** 1 Hr., **Practical:** 1 Hr.)

Course Description

This course covers basic concept of statistics, measurement of central tendency; correlation & regression analysis, probability, sample survey, sample survey methods and design of experiment. These topics are essential tools for research.

Course Objective

The general objectives of this course are to provide fund a mental concept of Statistics. Probability, Sample Survey and their applications in the area of Social Science and Computer Application.

Course Contents

Unit 1 Introduction to Statistics

Meaning. Scope and Limitations of Statistics, Types and Sources of Data, Methods and Problems of Collection of Primary and Secondary Data.

Unit 2 Descriptive Statistics

Measure of Central Tendency (Arithmetic Mean, Median, Partition Values, Mode, Partition Values, Mode) Measure of Dispersion (Absolute and Relative Measures: Range, Quartile Deviation, Mean Deviation, Standard Deviation, and Coefficient of Variation)

Unit 3 Correlation and Regression Analysis

Correlation: Definition, Scatter diagram, Karl Pearson's coefficient of correlation, Numerical problems for determination of Correlation Coefficients. Regression: Definition. Dependent and Independent Variables, Least Square method only, Numerical Problems.

Unit 4 Probability

Definition of Probability, Two basic Laws of Probabilit y(without proof). Conditional Probability; Probability Di stributions (Binomia l, Poi sson and Normal); simple numerical problems.

Unit 5 Sample Survey

Concept of Population and Sample; Needs of Sampling: Censuses and Sample Survey; Basic Concept of Sampling: Organizational Aspect of Sample Survey: Questionnaire Design; Sample Selection and Determination of Sample Size, Sampling and Non Sampling Errors.

Unit 6 Sample Survey Methods

Types of Sampling; Simple Random Sampling with and without Replacement; Stratified Random Sampling; Ratio and Regression Method of Estimation under Simple and Stratified Random Sampling, Systematic Sampling, Cluster Sampling; Multistage Sampling; Probability Proportion to Size Sampling (PPS), Estimation of Population Total and its Variance. Sampling Distributions (t, χ^2, z) and Related Problems.

Unit 7 Design of Experiment

Concept of Analysis of Variance (ANOVA), F-Statistic and its Distribution, Linear Model in ^NOVA, Analysis of One Way, Two Way Classification (1 and m observations per cell) in Fixed Effect Model.

Laboratory Works

Techniques for using the computer as a tool in the analysis of statistical problems will be introduced. SPSS software should be used for data analysis.

Hrs.

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will detem1ine the choice of teaching pedagogy as per the need of the topics.

Hrs.

Evaluation

Irs.

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	100

Text Books

1. Mukhopadhyay P., "Theory and Methods of Survey Sampling", Prentice of India, New Delhi, 1998.
2. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, India, Academic Press, 2005.

Irs.

Reference Books

1. Cochran W.G., "Sampling Techniques", 3rd edition on John Wiley and Sons, Inc. New York, 1977
2. Hogg and Tanis, "Probability and Statistical Inference", 6th edition, First India Reprint, 2002.
3. Montgomery Douglas C, "Design and Analysis of Experiment", 5th edition, John Wiley and sons Inc. 2001.
4. Uppadhayay H.P. Paudel, K.C. and etal, Elements of Business Mathematics", Pinncale Publication.

rs.

TRIBHUVAN UNIVERSITY

Faculty of Humanities & Social Sciences

OFFICE OF THE DEAN

TU QUESTIONS-ANSWERS 2019

Bachelor in Computer Applications Full Marks: 60
Course Title: Probability and Statistics **Pass Marks: 24**
Code No: CAST 202 **Time: 3 hours**
Semester: III

Candidates are required to answer the questions in their own words as far as possible.

Group A

Attempt all the questions. **[10×1 = 10]**

1. Circle (O) the correct answer.

i. How many types of data on the basis of sources of data collection?
a) 1 b) 2 c) 3 d) 4

ii. Which is more appropriate central tendency to find the average of profit?
a) Arithmetic Mean b) Median
c) Mode d) All

iii. What is the range of Correlation?
a) 0 to ∞ b) −∞ to ∞ c) −1 to 1 d) 0 to 1

iv. If r = 0.2 then coefficient of determination implies that
a) 20% of total variation in dependent variable has been explained by independent variable.
b) 40% of total variation in dependent variable has been explained by independent variable.
c) 2% of total variation in dependent variable has been explained by independent variable.
d) 4% of total variation in dependent variable has been explained by independent variable.

v. What is the minimum value of Probability?
a) 1 b) 100 c) 0 d) None of above

vi. In case of Normal distribution
a) Mean > Median b) Mean = Median
c) Mean ≤ Median d) Mean ≥ Median

vii. The regression line of X on Y and Y on X are intersect at the point
a) $(\mu, 0)$ b) (a, b) c) (X, Y) d) $(\bar{X}, \bar{Y})$

viii. In case of systematic sampling
a) sample mean is biased estimator population mean.
b) sample mean is unbiased estimator population mean.
c) sample mean can't estimate population mean.
d) sample mean may equal to population mean.

ix. Mean of Chi-Square distribution with n degrees of freedom is
a) 1 b) 0
c) 2n d) n

x. How do you obtain degree of freedom in one-way ANOVA?
a) (k, n-1) b) (k, n-k) c) (k-1, n-1) d) (k-1, n-k)

Answer-Key

i. (b)	ii. (a)	iii. (c)	iv. (d)	v. (c)	vi. (b)	vii. (d)	viii. (b)	ix. (d)	x. (d)

Group B

Attempt any SIX questions. **[6 × 5 = 30]**

2. Describe scope and limitation of Statistics.

Sol^n: Statistics is the Scientific method of collecting, organizing, presenting, analyzing and interpretation of data. Nowadays the scope of statistics has widened to social and economic phenomenon with the developments to social and economic phenomenon with the developments in the statistical technique. It is impossible to any sphere of human activity. Where statistics does not used some of them are listed below:

i. Statistics help in understanding the economic problems, formulation of economic policies and developing the economic theory for economic proper planning.

ii. Statistics is very helpful for formulating policies regarding business and forecasting future trends of the demand for the product.

iii. Statistics is the scientific method of making a wise decision in the face of uncertainty.

iv. Efficient administration cannot be perceived without statistics.

v. Statistical methods are extensively used in every type of research works such as agriculture, health, social science etc.

Although there are so many applications of statistics in every field, it is not without limitations. The main limitations of statistics are as follows:

i. Statistics does not deal with individuals.

ii. Statistics deals only with quantitative characteristics.

iii. Statistical results are not accurately correct.

iv. Statistical results are true only on an average.

v. Statistics is only are of the method of studying a problem.

vi. Statistics is liable to be misused easily.

vii. Statistics ignores the quantitative aspects.

3. Determine average wages from following data:

Wages	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70
No. of Worker	10	13	18	21	24	28	20	11	8

Sol^n: We know that the average wages is given by the formula:

$$\text{Average wages, } \bar{X} = A + \frac{\Sigma fd'}{N} \times h \quad \text{....(i)}$$

Where,

X denote the mid-value of wages.
f denote the number of workers.
A denote the assumed mean of X

$d' = \frac{X - A}{h}$, h is the common factor.

$N = \Sigma f$

Calculation of average wages of the workers

Wages	Number of workers (f)	Mid-value (X)	$d' = \frac{X - 47.5}{5}$	fd'
25 - 30	10	27.5	- 4	- 40
30 - 35	13	32.5	- 3	- 39
35- 40	18	37.5	- 2	-36
40 - 45	21	42.5	- 1	- 21
45 - 50	24	47.5	0	0
50 - 55	28	52.5	1	28
55- 60	20	57.5	2	40
60 - 65	11	62.5	3	33
65 - 70	8	67.5	4	32
Total	N = Σf = 153			Σfd' = - 3

Now form equation (i) we have

Average wages, $\bar{X} = A + \frac{\Sigma fd'}{N} \times h = 47.5 + \frac{(-3)}{153} \times 5 = 47.5 - 0.098 = 47.402$

Hence the average wages of the workers is Rs. 47.402.

4. **Calculate Karl Pearson's correlation coefficient from the following data:**

Sales	43	41	36	34	50
Expenses	10	22	13	19	17

Solⁿ: Let X denote the Sales and Y denote the Expenses then the Karl Pearson's correlation coefficient between X and Y is given by the formula:

$$r = \frac{n\Sigma uv - \Sigma u \times \Sigma v}{\sqrt{n.\Sigma u^2 - (\Sigma u)^2}\sqrt{n\Sigma v^2 - (\Sigma v)^2}} \quad ...(i)$$

Where,

u = X – A, A is the assumed mean of X-series

v = Y – B, B is the assumed mean of Y - series

Calculation of Karl Person's coefficient of correlation

Sales (X)	Expenses (Y)	u = X - 4	v= Y - 17	u^2	v^2	uv
43	10	2	- 7	4	49	- 14
41	22	0	5	0	25	0
36	13	- 5	- 4	25	16	20
34	19	- 7	2	49	4	- 14
50	17	9	0	81	0	0
Total	n = 5	Σu = - 1	Σv = - 4	$\Sigma u^2 = 159$	$\Sigma v^2 = 94$	Σuv = - 8

Now from equation (i) we have,

$$r = \frac{5 \times (-8) - (-1) \times (-4)}{\sqrt{5 \times 159 - (-1)^2}\sqrt{5 \times 94 - (-4)^2}} = \frac{-40 - 4}{\sqrt{794}\sqrt{456}} = \frac{-4}{600.4} = - 0.073$$

Hence the Karl Pearson's coefficient of correlation between Sales and Expenses is -0.073. This indicates there is very low degree of negative correlation between them.

5. **Estimate the marks in JAVA when the marks in Statistics is 65 by using following data:**

Marks in Statistics	57	58	59	59	60	61	62	64
Marks in JAVA	77	78	75	78	82	82	79	81

Solⁿ: Let X denotes the marks in Statistics and Y denote the marks in JAVA. To estimate the marks in JAVA when the mark in Statistics is given, we have to find the regression equation of Y on X.

Suppose the regression equation of Y on X is given by

$Y = a + bX$ ....(i)

Where the value of 'a' and 'b' are obtained by solving the normal equations.

$\Sigma Y = na + b\Sigma X$ ....(ii)

$\Sigma XY = a\Sigma X + b\Sigma X^2$ .....(iii)

Calculation of regression coefficient and regression equation

Marks in Statistics (X)	Marks in JAVA (Y)	XY	X^2
57	77	4389	3249
58	78	4524	3364
59	75	4425	3481
59	78	4602	3481
60	82	4902	3600
61	82	5002	3721
62	79	4898	3844
64	81	5184	4096
$\Sigma X = 480$	**$\Sigma Y = 632$**	**$\Sigma XY = 37944$**	**$\Sigma X^2 = 28836$**

Here, $n = 8$, $\Sigma X = 480$, $\Sigma Y = 632$, $\Sigma XY = 37944$, $\Sigma X^2 = 28836$

Substituting the values in equation (ii) and (iii) we get

$632 = 8a + 480b$ and

$37944 = 480a + 28836b$

On solving the above equations we get

$a = 39$ and $b = 0.667$

Now equation (i) becomes:

Hence the estimating equation of Y on X is given by,

$Y_e = 39 + 0.667X$

Now when, marks in statistics is 65, i.e. X = 65 the estimate Marks in JAVAA is given by,

$Y_e = 39 + 0.667 \times 65 = 82.355 \approx 82$

Hence when the marks in statistics is 65 them the estimate marks in JAVS is 82 (approximately)

"Alternative Method"

Calculation for regression equation of Y on X

Marks in Statistics,(X)	Marks in JAVA (Y)	u = X - 60	v= Y - 78	uv	u^2
57	77	- 3	- 1	3	9
58	78	- 2	0	0	4
59	75	- 1	-3	3	1
59	78	- 1	0	0	1
60	82	1	4	4	1
61	82	1	4	4	1
62	79	2	1	2	4
64	81	4	3	12	16
Total	**n = 8**	**$\Sigma u = 0$**	**$\Sigma v = 8$**	**$\Sigma uv = 24$**	**$\Sigma u^2 = 36$**

Hence, $u = X - A = X - 60$ and $v = Y - B = Y - 78$

Now the regression equation of v on u is given by

$v = a + bu$ .....(A)

Where a and b are given by the normal equations

$\Sigma v = na + b\Sigma u \Rightarrow 8 = 8a + b.0 \Rightarrow a = 1$

And $\Sigma uv = a\Sigma u + b\Sigma u^2 \Rightarrow 24 = a \times 0 + 36b \Rightarrow b = \frac{24}{36} = 0.667$

Now equation (A) reduced to,

$v = 1 + 0.0667 \times u$

$Y - 78 = 1 + 0.067\,(X - 60)$

or, $Y = 78 + 1 + 0.0667X - 40.02$

or, $Y_e = 39 + 0.667X$

$\therefore$ Now where $X = 65$ the, $Y_e = 39 + 0.667 \times 65 = 82.33 \approx 82$

Hence the mark in JAVA is 82 when the marks in Statistics are 65.

6. **Fit Binomial Distribution from the following data where p = 0.5**

Number of heads	0	1	2	3	4
Frequency	28	62	46	20	4

Sol^n: Here given data is

Number of heads, (X)	0	1	2	3	4	Total
Frequency, (f)	28	62	46	20	4	$N = \Sigma f = 160$

Let the number of heads denote by X, then X is the discrete random variable following the Binomial distribution with parameter n and p.

Here, the number of heads, n = 4

The probability of success in single trial, $p = 0.5 = \frac{1}{2}$

The probability of failure in a single trial, $q = 1 - p = 1 - \frac{1}{2} = \frac{1}{2}$

Now, the probability mass function, of Binomial distribution is given by,

$$P(X = x) = P(x) = C(n,x)P^x.\,q^{n-x} = C(4, x)\left(\frac{1}{2}\right)^x\left(\frac{1}{2}\right)^{4-x} \quad .....(i)$$

The expected frequency is obtained by Substituting the values of X = x = 0, 1, 2, 3, 4 in (i)

The Binomial distribution of the given data is given as

Number of heads (X = x)	$P(X=x) = C(4,x)\left(\frac{1}{2}\right)^x\left(\frac{1}{2}\right)^{4-x}$	Expected frequency $N \times P(X = x)$
0	$P(X=0) = C(4,0)\left(\frac{1}{2}\right)^0\left(\frac{1}{2}\right)^{4-0} = \frac{1}{16}$	$160 \times \frac{1}{16} = 10$
1	$P(X=1) = C(4,1)\left(\frac{1}{2}\right)^1\left(\frac{1}{2}\right)^{4-1} = \frac{1}{4}$	$160 \times \frac{1}{4} = 40$
2	$P(X=2) = C(4,2)\left(\frac{1}{2}\right)^2\left(\frac{1}{2}\right)^{4-2} = \frac{3}{8}$	$160 \times \frac{3}{8} = 60$
3	$P(X=3) = C(4,3)\left(\frac{1}{2}\right)^3\left(\frac{1}{2}\right)^{4-3} = \frac{1}{4}$	$160 \times \frac{1}{4} = 40$
4	$P(X=4) = C(4,4)\left(\frac{1}{2}\right)^4\left(\frac{1}{2}\right)^{4-4} = \frac{1}{16}$	$160 \times \frac{1}{16} = 10$
Total	$\Sigma P(X=x) = 1$	160

7. **How do you determine sample size in sampling? Explain briefly.**

Sol^n: Sample selection and determination of Sample size

Selection of suitable size of sample from population is an important task in sample survey. After determining sample size sample should be selected. The size of sample plays a vital role in sampling. It has direct bearing on the accuracy, estimation, cost and administration of the survey. Large sample has low sampling error where as small sample have higher sampling error. To avoid unnecessary cost small sample should be selected. Hence optimum sample size should be selected to fulfill the requirement of efficiency, representativeness, reliability and flexibility. Some of the factors affecting the sample size are nature of study, nature of reaction of respondent towards the subject under study, nature of population i.e. composition of population under study, number of classes in the population, types of sampling used during study etc.

Sample Size associated with Population Variance

Let d be the margin of error, which is difference between actual value and estimated value, σ be the population standard deviation and α be level of significance then sample size for infinite population is

$$n = \frac{\sigma^2 Z^2_{\alpha/2}}{d^2}$$

If population variance is unknown, then use sample variance (s^2) instead of σ^2

$$n = \frac{S^2 Z^2_{\alpha/2}}{d^2}$$

For finite population of size N sample size $= \dfrac{n}{1 + \dfrac{n}{N}}$

8. **Write short notes on simple random sampling.**

Sol^n: Simple Random Sampling

It is the most common and the simplest method of sampling in which each sample unit is selected from a population with equal probability. There are two types simple random sampling:

i. **Simple Random Sampling with Replacement:** A simple random sampling process; in which a unit is selected from a population, noted it and then returned back to the population before selecting a next unit from the population is called a simple random sampling with replacement (SRSWR). This process is repeated 'n' times to get a sample of 'n' units. In this case same sample may be repeated. Probability of selection of sample remains constant and is equal to 1/N for selection of each sample. A sample of size n can be selected from population of size N in N^n ways.

ii. **Simple Random Sampling without Replacement:** A simple random sampling process; in which a unit is selected from a population, noted it and not returned back to the population before selecting a next unit from the population is called a simple random sampling without replacement (SRSWOR). This process is repeated 'n' times to get a

sample of 'n' units. In this case samples are not repeated. Probability of selection of sample goes on changing for each selection. Probability is 1/N. 1/N-1, 1/N-2 and so on for selection of first sample, second sample, third sample and so on .A sample of size n can be selected from population of size N in C(N, n) ways.

Selection of Simple Random Sampling

Simple random sampling is the purest form of probability sampling and is commonly used in research. There are two aspects of performing simple random sampling viz. SRS with replacement (the item which is selected already also has a chance to select in new draw) and SRS without replacement.

SRS can be done by any of the following method

i. **Lottery method**

This method involves three steps. First step is constructing the sampling frame, i.e. list of units of the target population, e.g. students' list, member list of FNCCI etc in alphabetical order and numbered accordingly. Second step is writing numbers listed in the sampling frame on small piece of papers and placing these papers in some vessel/drum/jar etc. Third step is mixing all papers well and tacking out one piece of paper from the jar. This process is continued until the required number of respondents is reached.

ii. **Mechanical Randomization or Random Number Method**

A random number table is an arrangement of digits 0 to 9, in either a linear or rectangular pattern where each position is filled with one of these digits. A table of random numbers is so constructed that all numbers 0, 1, 2, . . ., 9 appear independent of each other. Some random tables in common use are

- Tippett's random number tables
- Fisher and Yate's table
- Kendall and Smith table
- A million random number

Random number tables are the tables of digit 0,1, 2,...9 each digit having equal chance of selection at any draw. In 1927, Tippet produced 41,600 digits (from 0 to 9) arranged in set of 4 in several columns and spread over 26 pages. This was followed by another publication by two great pioneering statisticians, Sir RA Fisher and Frank Yates, which contained 15,000 digits formed by listing 15-19th digits in some 20 figure logarithm tables. Rand Corporation (1955) Published table containing 1 million digits. Kendall and smith (1938) published tables with 100,000.

Group C

Attempt any TWO questions. **[2 × 10 = 20]**

9. **Student's age in the regular daytime BCA program and the morning time BCA program of a campus are described by two samples. If the homogeneity in age of the class is positive factor in learning make suggestion, with reason, which of two groups will be easier to teach?**

Regular BCA program		Morning BCA program	
Age	Number of Students	Age	Number of Students
23	9	27	10
29	2	31	8
28	5	30	5
22	10	29	4
30	1	28	6
21	4	33	5
25	11	34	5
26	6	35	11
27	3	36	2
24	9	32	4
Total	60	Total	60

Sol^n: Let X denote the age distribution of 'Regular BCA Program' day time students and Y denote the age distribution of 'Morning BCA Program' Morning time students and f denote the number of students.

If the homogeneity in age of the class is positive factor in learning, so in order to determine, which of two groups will be easier to teach we have to compare their coefficients of variations. The coefficient of variation can be obtained by using the formula,

$$C.V. = \frac{\sigma}{\bar{X}} \times 100\% \qquad \ldots (i)$$

Computation for mean and standard deviation

Regular BCA Program					Morning BCA Program				
X	d = X – 25	f	Fd	fd²	Y	d = Y – 31	f	fd	fd²
23	– 2	9	– 18	36	27	– 4	10	– 40	160
29	4	2	8	32	31	0	8	0	0
28	3	5	15	45	30	– 1	5	– 5	5
22	– 3	10	– 30	90	29	– 2	4	– 8	16
30	5	1	5	25	28	– 3	6	– 18	54
21	– 4	4	– 16	64	33	2	5	10	2
25	0	11	0	0	34	3	5	15	45
26	1	6	6	6	35	4	11	44	176
27	2	3	6	12	36	5	2	10	50
27	– 1	9	– 9	9	32	1	4	4	4
Total		N = 60	Σfd = – 33	Σfd = 319			N = 60	Σfd = 12	Σfd² = 512

For Regular BCA Program

$$\text{Mean age, } \bar{X} = A + \frac{\Sigma fd}{N} = 25 + \frac{(-33)}{60} = 25 - 0.55 = 24.45$$

$$\text{S.D. age, } \sigma_x = \sqrt{\frac{\Sigma fd^2}{N} - \left(\frac{\Sigma fd}{N}\right)^2} = \sqrt{\frac{319}{60} - \left(\frac{-33}{60}\right)^2} = \sqrt{5.3167 - 0.3025} = 2.24$$

$$C.V. (X) = \frac{\sigma_x}{\bar{X}} \times 100\% = \frac{2.24}{24.45} \times 100\% = 9.16\%$$

For Morning BCA Program:

Mean age, $\bar{Y} = B + \frac{\Sigma fd}{N} = 31 + \frac{12}{60} = 31 + 0.2 = 31.2$

S.D. Age, $\sigma_y = \sqrt{\frac{\Sigma fd^2}{N} - \left(\frac{\Sigma fd}{N}\right)^2} = \sqrt{\frac{512}{60} - \left(\frac{12}{60}\right)^2} = \sqrt{8.533 - 0.04} = 2.914$

C.V. $(Y) = \frac{\sigma_y}{\bar{Y}} \times 100\% = \frac{2.914}{31.2} \times 100\% = 9.34\%$

Since the coefficient of variation of age of students for regular BCA Program is less than the coefficient of variation of age of the students for morning BCA program, the age of the students for regular BCA program is more homogeneous in the comparison of the age of the students for morning BCA program. Hence the students for regular BCA program is easier to teach.

10. **Given a Normal distribution with mean 200 and S.D. 20, find the probability that**

i) $P(X > 180)$ ii) $P(X < 220)$ iii) $P(160 < X < 240)$

iv) $P(X > 220)$ v) $P(X < 180 \text{ or } X > 220)$

vi) 10% of the values are less than what values of X?

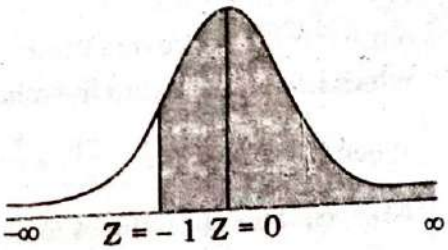
Sol^n: We have given, X be the continuous random variable with parameter mean, $\mu = 200$ and standard deviation, $\sigma = 20$. i.e. $X \sim N(200, 400)$

Let Z denote the continuous random variable defined by $Z = \frac{X - \mu}{\sigma}$. Then Z follow the standard normal distribution.

i.e. $Z \sim N(0, 1)$

Now,

i. $P(X > 180)$



$= P\left(\frac{X - \mu}{\sigma} > \frac{180 - \mu}{\sigma}\right)$

$= P\left(Z > \frac{180 - 200}{20}\right)$

$= P(Z > -1)$

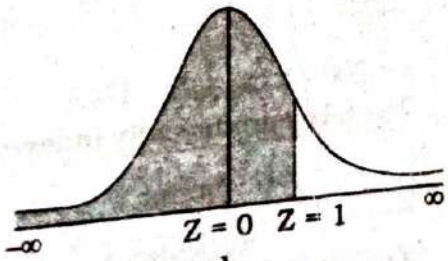
$= P(-1 < Z < 0) + P(0 \le Z < \infty)$ [∵ From the above figure]

$= P(0 < Z < 1) + 0.5$ [∵ By symmetry]

$= 0.3413 + 0.5$ [∵ from Z - table]

$= 0.8413$

ii. $P(X < 220)$



$= P\left(\frac{X - \mu}{\sigma} > \frac{220 - 200}{20}\right)$

$= P(Z < 1)$

$= P(-\infty < Z < 0) + P(0 \le Z < 1)$ [∵ from the above figure]

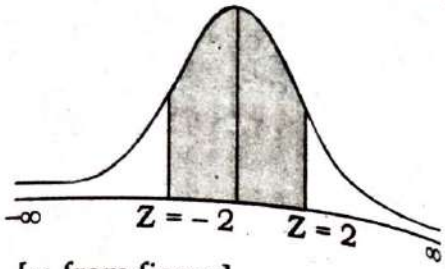
$= 0.5 + 0.3413 = 0.8413$ [∵ from Z-table]

$= 0.8413$

iii. $P(160 < X < 240)$

$= P\left(\frac{160-200}{20} > \frac{X-\mu}{\sigma} < \frac{240-200}{20}\right)$

$= P(-2 < Z < 2)$



$= P(-2 < Z < 0) + P(0 \le Z < 2)$ [∵ from figure]

$= P(0 < Z < 2) + P(0 \le Z < 2)$ [∵ By Symmetry]

$= 2 \times P(0 \le Z < 2)$ [∵ From Z-table]

$= 2 \times 0.4772$

$= 0.9544$

iv. $P(X > 220)$

$= 1 - P(X \le 220)$

$= 1 - 0.8413$ [From question (ii) $P(X \le 220) = 0.8413$]

$= 0.1587$

v. $P(X < 180 \text{ or } X > 220)$

$P(X < 180) + P(X > 220)$ [∵ $X < 180$ and $X > 220$ are independent events]

$= 1 - P(X > 180) + P(X > 220)$

$= 1 - 0.8413 + 0.1587$

$= 0.3174$

vi. Let 10% of the values are less than x then, we get,

$P(X \le x) = 10\% = 0.1$ . . . (i)

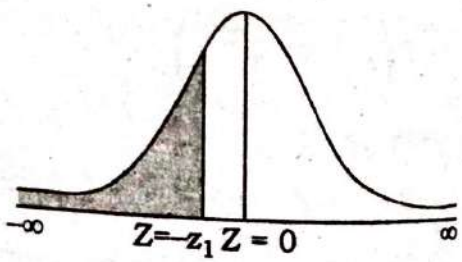
Since the value x covers the area less than 10%1

which lies on the left to the mean area i.e. 10% being less than 50% area. So,

When $X = x$ then $Z = \frac{X-\mu}{\sigma} = \frac{x-200}{20} = -z_1$

Now, equation (i) reduces to,

$P\left(\frac{X-\mu}{\sigma} \le \frac{x-\mu}{\sigma}\right) = 0.1$



or, $P(Z \le -z_1) = 0.1$

or, $P(-\infty < Z < 0) - P(0 < Z \le z_1) = 0.1$

or, $0.5 - P(0 < Z \le z_1) = 0.1$

∴ $P(0 < Z \le z_1) = 0.4$

∴ $P(0 < Z \le z_1) = P(0 < Z \le 1.295)$

∴ $z_1 = 1.285$

$\frac{x-200}{20} = -1.285$

∴ $x = 200 - 1.285 \times 20 = 174.3$

11. The labor productivity indexes of Nepal are recorded as below:

Sector	Year		
	2015	2016	2017
Agriculture	100	125	138
Manufacturing	100	60	53
Community and Social service	100	89	80

Does the labor productivity index vary due to the;

i. difference in the sector ii. Difference in the time period?

Sol^n: Here the factor of variation are,

A: Sectors, represented along the rows of the given table

B: Time period in year, represented along the column of the given table.

i. For Sector:

Null Hypothesis, H_{OA}: $\mu_1 = \mu_2 = \mu_3$

There is no any significant difference between the sectors.

After native Hypothesis, H_{1A}: $\mu_1 \neq \mu_2 \neq \mu_3$ that is at least two of the sectors differ significantly

ii. For time period (Years)

Null Hypothesis, H_{OB}: $\mu_1 = \mu_3 = \mu_3$

There is no any significant difference between the time period. Alternative Hypothesis, H_{1B}: $\mu_1 \neq \mu_2 \neq \mu_3$

That is at least two of the time period (in years) differ significantly.

Let us define:

X_{ij} = The labour productivity indices of Nepal in Sectors i and at time period j.

m = The number of rows = The number of sectors = 3

n = The number of columns = The number of time period = 3

Calculations for Various S.S.

Sectors	Time Period (Years)			Row Totals (T_i)	$(T_i)^2$
	2015	2016	2017		
Agriculture	100	125	138	363	131769
Manufacturing	100	60	53	213	45369
Community and Social Service	100	89	80	269	72361
Column Total (T_j)	**300**	**274**	**271**	**G =845**	**$\Sigma(T_i)^2$ = 249499**
$(T_j)^2$	**90000**	**75076**	**73441**	**$\Sigma(T_j)^2$ = 238517**	

Here we have,

m = 3 and n = 3

Total number of observations:

$N = m \times n = 3 \times 3 = 9$

Correction factor, $C.F. = \frac{G^2}{N} = \frac{(845)^2}{9} = 79336.11$

$$TSS = \sum_{i=1}^{m}\sum_{j=1}^{n} X_{ij}^2 - \frac{G^2}{N}$$

$$= [100^2 + 125^2 + 138^2 + 100^2 + 60^2 + 53^2 + 100^2 + 89^2 + 80^2] - 79336.11$$

$$= 85399 - 79336.11 = 6062.89$$

$$SSA = \frac{\Sigma T_i^2}{n} - \frac{G^2}{N} = \frac{249499}{3} - 79336.11 = 83166.33 - 79336.11 = 3830.22$$

$$SSB = \frac{\Sigma T_j^2}{m} - \frac{G^2}{N} = \frac{238517}{3} - 79336.11 = 79505.67 - 79336.11 = 169.56$$

$$SSE = TSS - SSA - SSB = 6062.89 - 3830.22 - 169.56 = 2063.11$$

ANOVA TABLE

Sources of Variation	Degree of Freedom (df)	Sum of square (SS)	Mean square (MS)	F_{calc}	F_{tab}
Sectors (A)	m - 1 = 2	3830.22	$\frac{3830.2}{2} = 1915.11$	3.713	6.9443
Time Period (B)	n - 1 = 2	169.56	$\frac{169.56}{2} = 84.78$	0.164	6.9413
Error	(m - 1) (n - 1) = 4	2063.11	$\frac{2063.11}{4} = 515.78$		
Total	**mn - 1 = 8**	**6062.89**			

Test statistic: The test statistics under null hypothesis, H_0 is.

$$F_R = \frac{MSR}{MSE} = \frac{1915.11}{515.78} = 3.713 \text{ and } F_C = \frac{MSC}{MSE} = \frac{84.78}{515.78} = 0.164$$

Critical Value: Since the level of significance is not given, let us choose $\alpha = 5\%$ then the critical value of F at $\alpha = 5\% = 0.05$ with degree of freedom (2, 4) is given by,

$F_{0.05}(2, 4) = 6.9443$

Decision:

Since the calculated Value of test statistics, $F_A = 3.713$ is less than the critical value $F_{0.05}(2, 4) = 6.9443$, therefore null hypothesis is accepted.

Since the calculated value of test statistics, $F_B = 0.164$ is less than the critical value $F_{0.05}(2, 4) = 6.9443$, therefore null hypothesis is accepted.

Hence null hypothesis is accepted for $\alpha = 5\%$.

Conclusion:

Hence there is no significant difference between the labour productivity indices of Nepal in various sector as well as in various time periods.

TRIBHUVAN UNIVERSITY
Faculty of Humanities & Social Sciences
OFFICE OF THE DEAN

TU QUESTIONS-ANSWERS 2020

Bachelor in Computer Applications **Full Marks: 60**
Course Title: Probability and Statistics
Code No: CAST 202 **Pass Marks: 24**
Semester: III **Time: 3 hours**

Candidates are required to answer the questions in their own words as far as possible.

Group B

Attempt any SIX questions. **[6 × 5 = 30]**

2. Discuss the role of statistics in computer application.

Ans: Statistics is used for various purpose in computer application. Statistics used for data mining, data compression, speech recognition, vision and image analysis, artificial intelligence and network, traffic modeling, quality management, software engineering, storage and retrieval processes, hardware engineering and manufacturing etc. Data mining is performed with help of statistics to find irregularities or inconsistencies in data. Data compression uses statistical algorithms to compress data. In speech recognition statistical model learn the pattern in audio that make sounds of speech. The models are used to automatically transcribe new speech. In vision and image analysis statistical learning techniques are used to recognize faces. In artificial and intelligence network statistics combines logical and probabilistic relation. In traffic modeling statistical techniques such as stochastic process and queuing theory are used to estimate and predict of flows in traffic network. Statistics provide solution of problem related to quality management such as quality planning, quality assurance, quality control and quality improvement. Statistical methods are used for controlling and improving the quality and productivity of practices used on creating software. In hardware engineering and manufacturing statistical tools such as quality control and process control are used to manage conformance to indicated specifications.

3. The following table shows the monthly salary of employees in a certain locality of Lalitpur metropolitan city

Salary(000 Rs)	Number of employees
0 – 10	15
10 – 20	22
20 – 30	28
30 – 40	35
40 – 50	24
50 – 60	20
60 – 70	16

Compute mean, median and mode

Ans:

Salary (000 Rs)	Number of employees (f)	Mid Salary (x)	fx	cf
0 – 10	15	5	75	15
10 – 20	22	15	330	37
20 – 30	28	25	700	65
30 – 40	35	35	1225	100
40 – 50	24	45	1080	124
50 – 60	20	55	1100	144
60 – 70	16	65	1040	160
	N = Σf=160		Σfx=5550	

Mean salary ($\bar{x}$) = Σfx/N = 5550/160 = 34.687

Hence mean salary is 34.687(000 rs)

Ti find median

N/2 = 160/2 = 80

Cf just greater than 80 is 100 for which corresponding class is (30 – 40)

Hence median class = (30 – 40)

L = 30, h = 10, f = 35, cf = 65

$$Md = L + \frac{\frac{N}{2} - cf}{f} \times h = 30 + \frac{80 - 65}{35} \times 10 = 34.285$$

Hence median salary is 34.285 (000 rs)

To find mode

(30 – 40) class has maximum frequency

Hence modal class = (30 – 40)

L = 30, h = 10, $f_0 = 28, f_1 = 35, f_2 = 24$

$$Mo = L + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h = 30 + \frac{35 - 28}{2 \times 35 - 28 - 24} \times 10 = 33.888$$

Hence modal salary is 33.888 (000 rs)

4. Define the term correlation. Determine Karl Pearson's coefficient of correlation between advertisement cost and sales as per the data given below

Advertisement cost(00 rs)	Sales (000 rs)
39	47
65	53
62	58
90	86
82	62
75	68
25	60
98	91
36	95

Ans: Two variables are correlated when a change in one variable is accompanied by change in other variable. When increase (decrease) in one variable is accompanied by increase (decrease) in other variable then correlation is positive. When increase (decrease) in one variable is accompanied by decrease (increase) in other variable then correlation is negative.

Advertisement cost(00 rs) x	Sales (000 rs) y	xy	x^2	y^2
39	47	1833	1521	2209
65	53	3445	4225	2809
62	58	3596	3844	3364
90	86	7740	8100	7396
82	62	5084	6724	3844
75	68	5100	5625	4624
25	60	1500	625	3600
98	91	8918	9604	8281
36	95	3420	1296	9025
$\Sigma x = 572$	**$\Sigma y = 620$**	**$\Sigma xy = 4036$**	**$\Sigma x^2 = 41564$**	**$\Sigma y^2 = 45152$**

Karl pearson's coefficient of correlation (r)

$$= \frac{n\sum xy - n\sum x\sum y}{\sqrt{n(\sum x^2 - (\sum x)^2)}\sqrt{n\sum y^2 - (\sum y)^2}} = \frac{9 \times 40636 - 572 \times 620}{\sqrt{9 \times 41564 - 572^2}\sqrt{9 \times 45152 - 620^2}} = 0.38$$

Hence karlpearson's coefficient of correlation is 0.38

5. **The following table gives age of computers of certain company and annual maintenance cost**

Age of computers (yrs)	Maintenance cost (00 rs)
2	10
4	15
6	22
8	32
10	46

Obtain regression equation of maintenance cost on age of computer. Also estimate cost of maintenance for 10 years old computers.

Ans:

Age of computers (yrs) x	Maintenance cost (00 rs) y	xy	x^2
2	10	20	4
4	15	60	16
6	22	132	36
8	32	256	64
10	46	460	100
$\Sigma x = 30$	**$\Sigma y=125$**	**$\Sigma xy=928$**	**$\Sigma x^2=220$**

To find regression equation

$$b = \frac{n\,\Sigma xy - \Sigma\Sigma x\Sigma y}{n\Sigma x^2 - (\Sigma x)^2} = \frac{5 \times 928 - 30 \times 1.25}{5 \times 220 - 30^2} = 4.45$$

$a = \bar{y} - b\,\bar{x} = \Sigma y/n - b\,\Sigma x/n = 125/5 - 4.45*30/5 = 25 - 4.45*6 = -1.7$

Hence regression equation is $y = a+bx = -1.7 + 4.45x$

When $x = 10$, $y = -1.7+4.45*10 = 42.8$

Hence estimated cost of maintenance for 10 years old computers is 42.8(00 rs) = Rs 4280

6. Fit poisson distribution to following data and find expected frequencies

x	0	1	2	3	4	5	6	7	8
f	56	156	132	92	37	22	4	0	1

Ans:

x	f	fx	$P(x) = \frac{e^{-\lambda}\lambda^x}{x!}$	Expected frequency = N p(x)
0	56	0	0.1666	83.3 ≈ 83
1	156	156	0.2985	149.25 ≈ 149
2	132	264	0.2675	133.75 ≈ 134
3	92	186	0.1597	79.85 ≈ 80
4	37	148	0.0715	35.75 ≈ 36
5	22	110	0.0256	12.8 ≈ 13
6	4	24	0.0076	3.8 ≈ 4
7	0	0	0.0019	0.95 ≈ 1
8	1	8	0.0004	0.2 ≈ 0
	N=∑f=500	**∑fx=896**		

Here, $\bar{x} = \Sigma fx/N = 896/500 = 1.792$

Hence $\lambda = \bar{x} = 1.792$

When x = 0, $P(0) = \frac{e^{-1.792}1.792^0}{0!} = 0.1666$ and so on

Expected frequency = N p(0) = 500 × 0.1666 = 83.3 ≈83 and so on

7. Find first quartile (Q_1), 7th decile (D_7) and 80th percentile (P_{80}) from the following data

Age in year	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90
Number of people	10	11	27	35	29	17	11	10

Ans:

Age in year	Number of people (f)	cf
10 – 20	10	10
20 – 30	11	21
30 – 40	27	48
40 – 50	35	83
50 – 60	29	112
60 – 70	17	129
70 – 80	11	140
80 – 90	10	150
	N = ∑f= 150	

To find Q_1, N/4 = 150/4 = 37.5

Cf just greater than 37.5 is 48 for which corresponding class is (30 – 40).

Hence Q_1 class is (30 – 40)

Here L = 30, h = 10, f = 27, cf = 21

$$Q_1 = L + \frac{\frac{N}{4} - cf}{f} \times h = 30 = 30 + \frac{37.5 - 21}{27} \times 10 = 36.111$$

To find D_7, 7N/10 = 7*150/10 = 105

Cf just greater than 105 is 112 for which corresponding class is (50 – 60).

Hence D_7 class is (50 – 60)

Here L = 50, h = 10, f = 29, cf = 83

$$D_7 = L + \frac{\frac{7N}{10} - cf}{f} \times h = 50 + \frac{105 - 83}{29} \times 10 = 57.58$$

To find P_{30}, 80N/100 = 80*150/10 = 120

Cf just greater than 120 is 129 for which corresponding class is (60 – 70).

Hence P_{30} class is (60 – 70)

Here L = 60 , h = 10 , f = 17, cf = 112

$$P_{30} = L + \frac{\frac{80N}{200} - cf}{f} \times h = 60 + \frac{120 - 112}{17} \times 10 = 64.705$$

Hence first quartile is 36.111. Seventh decile is 57.58 and eightieth percentile is 64.705

8. **A box contains 30 items of which 10 are defectives. If two items are selected randomly from the box without replacement what is the probability that (a) both are non-defective (b) both are defective**

Ans: Total items = 30

Defective items = 10

Non defective items = 30 – 10 = 20

Selected = 2 without replacement

Let defective item = D and non-defective item = N

(a) $P(Di \cap Dii) = P(Di)\, P(Dii/Di) = 10/30 \times 9/29 = 3/29 = 0.103$

(b) $P(Ni \cap Nii) = P(Ni)\, P(Nii/Ni) = 20/30 \times 19/29 = 0.436$

Hence probability that both items are defective is 0.103 if draw is made without replacement and probability that both items are non-defectives is 0.36 if draw is made without replacement

Group C

Attempt any TWO questions. **[2 × 10 = 20]**

9. The following data represents the scores made in an intelligence test by two group of students from section A and section B of National College

Student no.	1	2	3	4	5	6	7	8	9	10
Section A	9	8	10	6	7	6	7	8	9	10
Section B	10	8	6	8	9	8	7	8	5	8

Test which group is more consistent to make scores in the intelligence test on the basis of coefficient of variation

Ans:

Student no.	Section A (x)	Section B (y)	x^2	y^2
1	9	10	81	100
2	8	8	64	64
3	10	6	100	36
4	6	8	36	64
5	7	9	49	81
6	6	8	36	64
7	7	7	49	49
8	8	8	64	64
9	9	5	81	25
10	10	8	100	64
	$\sum x = 80$	$\sum y = 77$	$\sum x^2 = 660$	$\sum y^2 = 611$

Now,

$\bar{x} = \Sigma x/n = 80/10 = 8$

$\bar{y} = \Sigma y/n = 77/10 = 7.7$

$$\sigma_x = \sqrt{\frac{\Sigma x^2}{n} - \left(\frac{\Sigma x}{n}\right)^2} = \sqrt{\frac{660}{10} - \left(\frac{80}{10}\right)^2} = 1.345$$

$$CV_x = \frac{\sigma_x}{\bar{x}} \times 100 = 1.414 \times 100/8 = 17.675\%$$

$$CV_y = \frac{\sigma_x}{\bar{y}} \times 100 = 1.345 \times 100/7.7 = 17.467\%$$

Here $CV_y = 17.467\% < CV_x = 17.675\%$

Hence section B is more consistent

10. The life of certain electronic component is a normal random variate with mean 5000 hours and standard deviation 100 hours. Compute the probabilities under following conditions (a) life time of components is less than 5012 hours (b) life time of components between 4000 to 6000 hours (c) life time of components more than 7000 hours (d) life time of components less than 4800 hours

Ans: Let X = life time of certain electronic component

$x \sim N(\mu, \sigma^2)$; $\mu = 5000$ $\sigma = 100$

Define $Z = \frac{x - \mu}{\sigma} = \frac{x - 5000}{100}$

When $x = 5012$, $Z = \frac{5012 - 5000}{100} = 0.12$

When $x = 4000$, $Z = \frac{4000 - 5000}{100} = -10$

When $x = 6000$, $Z = \frac{6000 - 5000}{100} = 10$

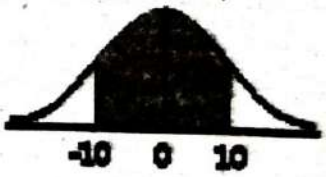
When $x = 7000$, $Z = \frac{7000 - 5000}{100} = 20$

When $x = 4800$, $Z = \frac{4800 - 5000}{100} = -2$

(a) $P(X < 5012) = P(Z < 0.12)$

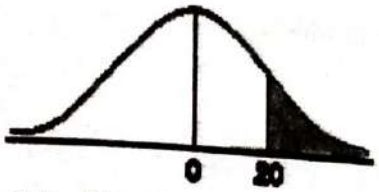
$= 0.5 + P(0 < Z < 0.12) = 0.5 + 0.0478 = 0.5478$

(b) $P(4000 < X < 6000) = P(-10 < Z < 10)$



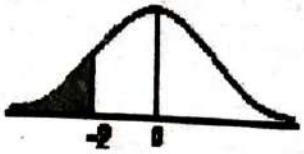
$= P(-10 < Z < 0) + P(0 < Z < 10) = P(0 < Z < 10) + P(0 < Z < 10) = 0.5 + 0.5 = 1$

(c) $P(X > 7000) = P(Z > 20)$



$= 0.5 - P(0<Z<20) = 0.5 - 0.5 = 0$

(d) $P(X < 4800) = P(Z < -2)$



$= 0.5 - P(-2< Z < 0) = 0.5 - P(0<Z<2) = 0.5 - 0.4772 = 0.0228$

Hence probability that life time of components is less than 5012 hours is 0.5478

Probability that life time of components between 4000 to 6000 hours is 1

Probability that life time of components more than 7000 hours is 0

Probability that life time of components less than 4800 hours is 0.0228

11. **Perform the ANOVA from two way classification**

Varieties \ Blocks	1	2	3
A	10	9	8
B	7	7	7
C	8	5	4
D	5	4	4

Ans: Problem to test

H_{0v} : Varieties are insignificant

H_{1v} : Varieties are significant

H_{0B} : Blocks are insignificant

H_{1v} : Blocks are significant

Varieties \ Blocks	1	2	3	T_i
A	10	9	8	27
B	7	7	7	21
C	8	5	4	17
D	5	4	4	13
T_j	30	25	23	G = 78

Here, variety (v) = 4 , block (b) = 3

$N = b \times v = 3 \times 4 = 12$

$G = \Sigma_{i=1}^{4} T_i = 78$

Total sum of square (TSS) $= \Sigma_{i=1}^{4} \Sigma_{j=1}^{4} y_{ij}^2 - G^2/N$

$= 10^2 + 9^2 + 8^2 + 7^2 + 7^2 + 7^2 + 8^2 + 5^2 + 4^2 + 5^2 + 4^2 + 4^2 - 78^2/12$

$= 554 - 507 = 47$

Sum of square due to varieties (SSV) $= \dfrac{\Sigma_{i=1}^{4} T_1^2}{b} - G^2/N$

$= \dfrac{27^2 + 21^2 + 17^2 + 13^2}{3} - 78^2/12$

$= 35.666$

Sum of square due to blocks (SSB) $= \frac{\Sigma_{i=1}^{4} T_i^2}{b} - G^2/N$

$= \frac{30^2 + 25^2 + 23^2}{4} - 78^2/12 = 6.5$

Sum of square due to error (SSE) $= TSS - SSV - SSB = 47 - 35.666 - 6.5$

$= 4.834$

ANOVA table

sv	df	SS	MS	F_{cal}	F tab
Varieties	3	35.666	11.888	$F_v = 13.106$	$F_{0.05\,(3,6)} = 4.76$
Blocks	2	6.5	3.25	$F_B = 3.583$	$F_{0.05\,(2,6)} = 5.14$
Error	6	4.843	0.907		
Total	11	47			

Decision

$F_v = 13.106 > F_{0.05\,(3,6)} = 4.76$

Reject H_{0V} at 5% level of significance

$F_B = 3.583 < F_{0.05\,(3,6)} = 5.14$

Accept H_{0B} at 5% level of significance

Conclusion

Varieties A, B, C and D are significant and Blocks 1,2 and 3 are insignificant.

MODEL QUESTIONS SETS FOR PRACTICE

MODEL SET 1

Group A

Attempt all the question **[10 × 1 = 10]**

1. Circle (O) the correct answer.

i. How many types of data on the basis of sources of data collection?
a) 1 b) 2 c) 3 d) 4

ii. The more appropriate measure of dispersion to compare the income of two employees is
a) Coefficient of Range b) Coefficient of Q.D.
c) Coefficient of M.D. d) Coefficient of variation

iii. How many partition values are there in quartiles?
a) 2 b) 3 c) 4 d) 9

iv. If r = 0.2 then coefficient of determination implies that
a) 20% of total variation in dependent variable has been explained by independent variable.
b) 40% of total variation in dependent variable has been explained by independent variable.
c) 2% of total variation in dependent variable has been explained by independent variable.
d) 4% of total variation in dependent variable has been explained by independent variable.

v. The probability of sure and certain event is
a) 100% b) 1 c) both of above d) none of above

vi. In case of Normal distribution
a) Mean > Median b) Mean = Median
c) Mean ≤ Median d) Mean ≥ Median

vii. The statistical measure obtained from population is called
a) Sample b) Statistic
b) Parameter d) Error

viii. Sample random sampling is used when
a) Population is homogeneous
b) Population is heterogeneous
c) Population is dispersed
d) None of above

ix. The hypothesis that the population variance has a specified value can be tested by
a) F – test b) Z–test c) t - test d) χ^2–test

x. The mean of F distribution can be obtained by
a) $\frac{n}{n-1}$ b) $\frac{n}{n-2}$ c) n d) $\frac{n-2}{n}$

Group B

Attempt any "SIX" questions. **[6 × 5 = 30]**

2. Discuss the application of statistic in computer application.
3. The income distribution of 1000 persons of a city is as follows:

Income (in Rs '000')	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25
Number of persons	160	200	400	200	40

Find the limits and range of marks of middle 60% of persons.

Ans: Rs. 6,000 to 16000, Rs. 10,000

4. Weights of a group of individuals are given below in kg. Find out the coefficient of variation of weight.

Weights (kg)	Above 0	Above 10	Above 20	Above 30	Above 40
Number of persons	100	88	25	25	10

Ans: 50.22%

5. Determine the degree of relationship between the ages of husband and their wife from the following data.

Age of husband (in yrs)	23	22	24	23	26	27
Age of wife (in yrs)	20	18	20	21	21	22

Find the coefficient of determination. Also interpret the result obtained.

Ans: r = 0.8 high degree of positive correlation, r^2 = 0.64, 64% of total variation in the age of wife has been explained by the age of husband.

6. On an average 4 customers arrives at a computer shop in every 5 minutes. Find the probabilities that there will be
   i. Exactly 2 customers arrive
   ii. at least one customers arrive
   iii. At most 4 customers arrive

   Ans: i. 0.1465 ii. 0.9817 iii. 0.6289
7. What is sampling error? Describe its causes.
8. A machine produces 20 defective articles in a batch of 400. After overhauling it produced 10 defectives in a batch of 300. Obtain the Z for the significance of the machine for defectives.

   Ans: Z = 1.34

Group C

Attempt any "TWO" Questions. **[2 × 10 = 20]**

9. From the following bi-variate table compute the most probable value of the sales revenue when the advertisement cost is Rs. 70, 000.

Sales Revenue (in Rs '000')	Advertisement Expenditure (in Rs. '000')			
	5 - 15	15 - 25	25 - 35	35 - 45
75 - 125	4	1	-	-
125 - 175	7	6	2	1
175 - 225	1	3	4	2
225 - 275	1	1	3	4

Ans: Rs. 426650

10. A Kathmandu municipality puts 1000 light bulbs on the streets of a city. It lives of bulbs follow a Normal distribution with a mean of 60 days and a standard deviation of 20 days, how many bulbs will have to be replaced after
    i. 40 days
    ii. 80 days
    iii. Between 30 and 70 days
    iv. If 30% of the bulbs have life x days then, find the value of x.

    Ans: i. 8413 ii. 1587 iii. 6247 iv. 50 days

11. A Professor wishes to select a good text book from four different ones available. He has 37 students whom he distributes at random into four groups of 9, 10, 11 and 7 students assigning the books at random to the groups. After the course is over, all the students take the same test obtaining scores as follows.

Test Books	A	B	C	D
Scores obtained in the test	68	41	54	44
	68	47	44	51
	69	54	51	69
	60	65	56	59
	73	32	47	59
	64	73	61	55
	71	44	59	66
	67	48	49	
	75	64	41	
		54	61	
			73	

Explain if any the four books is to be preferred over the others.

Ans: $F_{cal} = 5.66 > F_{tab} = 3.29$]

MODEL SET 2

Group A

Attempt all the questions: **[10 × 1 = 10]**

1. **Circle (O) the correct answer.**

i. If the mean and median of a distribution are 50 and 40 respectively then its mode is,

a) 70 b) 45 c) 30 d) 20

ii. Which of the following is the relative measure of dispersion?

a) C.V b) S.D c) Q.D. d) M.D

iii. The regression coefficient between two variables X and Y is independent of change of

a) Scale only b) Origin only
c) Origin and scale both d) Neither origin nor scale

iv. The calculated correlation coefficient between two variable X and Y is said to be significant if

a) r > P.E. (r) b) r < P.E (r) c) r > 6 × P.E. (r) d) r < 6 × P.E(r)

v. Which of the following represents data?

a) a single value b) Only two values in a set
c) a group of values in a set d) None of the above

vi. The probability of two persons having the birth day on the same day (ignoring date) is

a) $\frac{1}{365}$ b) $\frac{1}{49}$ c) $\frac{1}{30}$ d) $\frac{1}{7}$

vii. The parameters of the Normal distributions are,

a) n and λ b) μ and σ c) n and p d) p and q

viii. How sampling error can be reduced?

a) By increasing the sample size
b) By increasing the population size
c) By decreasing the sample size
d) By decreasing the population size

ix. t - distribution is used

a) For large sample test
b) For independent test
c) For small sample test
d) Non of above

x. ANOVA is used in order to,

a) test equality of two means
b) test equality of three or more means
c) test equality of three or more variance
d) test equality of correlation coefficient

Group B

Attempt any 'SIX' questions **[6 × 5 = 30]**

2. What do you understand by data? Distinguish between primary and secondary data.

3. The following table represents the marks of 100 students

Marks	0 - 20	20 - 40	40 - 60	60 - 80	80 - 100
Number of students	14	-	27	-	15

If the median is 48 find the missing frequencies. **Ans: 25 and 19 respectively**

4. A bag contains 5 white and 3 black balls. Two balls are drawn at random one after another without replacement. Find the probability that both balls draw are

i. Different colours ii. Same colours **Ans: i. $\frac{15}{28}$, ii. $\frac{13}{28}$**

5. What sampling and non-sampling error? Mention their causes.

6. Ten TOEFL preparation students scored 70, 65, 60, 82, 90, 68, 75, 77, 62 and 60 in January. The same ten students scored 78, 62, 75, 90, 95, 75, 80, 82, 60 and 81 in February. Obtain t for significance. **Ans:** 3.069

7. Two horses A and B were tested according to the time (in second) to run a particular track with the following results:

Horse A	28	30	32	33	33	29	34
Horse B	29	30	30	24	27	29	

Obtain F for significance. **Ans: 1.03**

8. Life time of HP Laptop is Normally distributed with mean life of 8 years and standard deviation of 2 years. What is probability that a HP Laptop works for i. More than 10 years.

ii. Between 6 years to 11 years **Ans: i. 0.158 ii. 0.7745**

Group C

Attempt any 'TWO' questions. **[2 × 10 = 20]**

9. The following table gives the monthly income of the workers in Kathmandu and Pokhara.

Monthly income (in Rs. '000')	Number of workers (in '000')	
	Kathmandu	Pokhara
45	5	32
50	15	22
55	20	15

60	20	12
65	12	10
70	10	6
75	9	2
80	9	1

Find in which city has greater inequality in the distribution of monthly wages. On the basis of the income make suggestion in which city the workers are more happier?

Ans: Pokhara has greater inequality in the monthly wage: the workers of Kathmandu are more happier.

10. The data in sales and promotion expenditures of a newly launched product for 6 years are given below.

Year	2013	2014	2015	2016	2017	2018
Sales (in Rs. 00,000)	16	20	18	24	20	22
Promotional Expenses (in Rs. '000)	4	4	6	10	10	12

i. Calculate the two regression coefficients.
ii. Compute the correlation coefficient between them and interpret it.
iii. Test the significance of the correlation coefficient
iv. Develop the estimating equation that describes the effect o promotional expenses on sale. Estimate the expected sales if the promotional expenses is Rs. 20, 000.

Ans: i. b_{xy} = 0.9 and b_{yx} = 0.61 ii. r= 0.74, highly positively correlated; iii. Nothing can be concluded certainly; iv. Y_e = Rs. 2752000

10. A manufacturing company has purchased three new machines of different makes and wishes to determine whether one of them is faster than the others in producing a certain output. Five, hours production figures are observed at random for each machine and the results are given below.

Machine	M_1	M_2	M_3
Observations	25	31	24
	30	39	30
	36	38	28
	38	42	25
	31	35	28

Use analysis of variance technique and determine whether the machines are significantly different in their mean speeds.

Ans: The machines M_1, M_2 and M_3 significantly

MODEL SET 3

Group A

Attempt all the questions: **[10 × 1 = 10]**

1. **Circle (O) the correct answer.**

i. The standard deviation and mean of a distribution are 4 and 25 respectively then the value of the coefficient of variation is,
a) 625% b) 125% c) 25% d) 16%

ii. The average income of the 15 workers of a company in different post is 30 (in Rs. '000'), how much the company should must pay for them
a) Rs. 2,000 b) Rs. 45,000 c) Rs. 4,50,000 d) Rs. 9,00,000

iii. Statistics deals with
a) Qualitative information
b) Quantitative information
c) Both (a) and (b)
d) Neither (a) nor (b)

iv. The Karl Pearson's correlation coefficient is independent of change of
a) Origin
b) Scale
c) Origin and Scale
d) All of above

v. In the regression line, Y = a + bX, b represent the
a) The scope of the line
b) Rate of change of Y with respect to X
c) Change in Y per unit change in X
d) All of above

vi. In a poisson distribution, if $\lambda = 4$ then the value of the standard deviation will be
a) 2
b) 4
c) 8
d) 16

vii. The probability distribution having standard deviation 1 and mean 0 (zero) is known as
a) Binomial distribution
b) Poisson distribution
c) Standard Normal distribution
d) Normal distribution

viii. The difference between parameter and statistic is known as
a) Standard error
b) Sampling error
c) Probable error
d) Non-sampling error

ix. We use Chi-square distribution in order to
a) test the goodness of fit
b) test the significance of correlation coefficient
c) test the significance of regression coefficient
d) test the significance of sample mean

x. If two way classifications has 5 rows and 4 columns, then what is the degree of freedom for error?
a) 3
b) 4
c) 12
d) 19

Group 'B'

Attempt any 'SIX' questions. **[6 × 5 = 30]**

2. The running capacity of two horses are given below, state which is more consistent and why?

Horse A	250	255	280	290	295	300
Horse B	280	282	290	295	298	295

Ans: C.V (B) < C.V. (A), Horse B

3. State the problems arises white collecting primary and secondary data.

4. Five coin are tossed 3200 times, find the expected frequencies of the distribution of heads and tails. Calculate the mean and standard deviation of the number of success.

Ans:

X act= r	0	1	2	3	4	5
f(r)	100	500	1000	1000	500	100

Mean = 2.5, S. D. = 1.118

5. From a sample of 400 tube light, computed mean and standard error of mean found to be 1250 hours and 25 hours respectively. What sample size should be taken to insure 99% confidence that the population mean lies within more or less 50 of the sample mean?

Ans: n = 660

6. A sample of 500 workers of a factory according to sex and nature of work is as follows:

Nature of work	Male	Female
Technical	200	100
Non-Technical	50	150

Obtain χ^2 for significance

Ans: 83.34

7. State the mathematical model with hypothesis to be tested in two-way ANOVA with m observation per cell. Write down the ANOVA table of it.

8. A random sample of 7 males selected from male group, the sum of the squared of deviation taken from mean was 320, white another random sample of 6 females selected from female group, the sum of squares of deviations from mean was found of be 350 in order to test whether the difference in sample variability is significant at 5% level of significance, find the value of F.

Ans: 1.31

Group - C

Attempt any 'TWO' questions. **[2 × 10 = 20]**

9. Before and after the implement of an economic program to uplift the economic condition of a commodity following information were found. Give your answer on the basis of statistical analysis of the available information.

Monthly income (in Rs '000')	Before the plan	After the plan
	Number of families	Number of families
4 - 6	10	8
6 - 8	70	65
8 - 10	35	37
10 - 12	20	15
12 - 14	10	15
14 - 16	3	5
16 - 18	2	5

i. Is there any improvement in the community in terms of average monthly income?

ii. Indicate the percent of amount changed in the highest income of the poorest 40% of the population before and after the plan.

iii. Indicate the percent of amount changed in the lowest income of richest 40% of the population before and after the plan.

Ans: i. there is an improvement in the community; ii. 2.29% iii. 4.08%

10. In a study, the following information were obtained;

Number of observations	9
Sum of product between two variables income X and expenditure (Y)	731
Sum of squares of income (X)	2085
Sum of squares of expenditure (Y)	258
Mean income	15
Mean expenditure	5

Find, i) Two regression coefficients

ii) Whether there exists any relationship between income and expenditure.

iii) The two regression lines

iv) The most probable amount of expenditure when income is Rs. 200.

Ans: i. 0.93, 0.93 ii. 0.93 iii. X = 0.93Y+ 10.33 and Y = 0.93X - 8 .9 iv. Y_e = Rs. 177.7

11. The marks obtained by 1000 students an examination are known to be normally distributed. If 15% of the students got less than 30 marks and 10% of the students got over 90, find the mean and standard deviation of the distribution.

Ans: μ = 56.89 and σ = 25.26

MODEL SET 4

Group A

Attempt all the questions:

1. Circle (O) the correct answer. **[10 × 1 = 10]**

i. If the covariance between two variables X and Y is 250, the variance of X and Y are 64 and 100 respectively then what is the correlation between X and Y?

a) $\frac{5}{16}$ b) $\frac{25}{64}$ c) $\frac{25}{80}$ d) $\frac{1}{256}$

ii. If A can solve 75% of the problem and B can solve 70% of the problem then what is the probability that the problem will be solved?

a) 1.45 b) 0.925 c) 1.975 d) 0.525

iii. The height of persons in a country is a random variable of the type:

a) Continuous random variable b) Discrete random variable

c) Bi-variate random variable d) All of above

iv. For a normal distribution with mean 8 and variance 64 the standard normal variate Z will be,

a) $Z = \frac{X-64}{8}$ b) $Z = \frac{X-8}{64}$ c) $Z = \frac{X-8}{8}$ d) $Z = \frac{8-X}{8}$

v. The relation between mean and variance in Chi-square distribution with n degree of freedom is,

a) $\bar{X} = 2\sigma^2$ b) $2\bar{X} = \sigma^2$ c) $\bar{X} = \sigma^2$ d) None of above

vi. What is called the F ratio?

a) Ratio of mean b) Ratio of standard deviation

c) Ratio of correlation coefficient d) Ratio of variance

vii. For testing that a bi-variate random sample has come from an uncorrelated population, the appropriate test is

a) Z- test b) F- test c) t - test d) χ^2 - test

viii. A coin is tossed 400 times and it turns up head 216 times. The hypothesis that the coin is unbiased can be tested by

a) χ^2 = test b) Z- test c) F- test d) both (a) & (b)

xi. What is limitation of statistics?

a) Used as means b) Used in estimation

c) Used in planning d) used in testing hypothesis

x. Which of the following can never be negative?

a) Measure of central tendency b) Measure of dispersion

c) Skewness and kurtosis d) Correlation and regression

Group - B

Attempt any 'SIX' questions. **[6 × 5 = 30]**

2. If the most repeated marks for a group of 94 students is 54. Find the number of students getting the marks between 20 - 40 and 60 - 80, from the data given below,

Marks	0 – 20	20 – 40	40 - 60	60 - 80	80 - 100
Number of students	10	-	30	-	14

Ans: 16 and 24

3. The mean and standard deviation of 100 items are found to be 40 and 12 respectively. If a the time of calculation, two items were wrongly taken as 23 and 15 instead of 43 and 18. Find he correct mean, standard deviation and coefficient of variation?

Ans: 40.23, 11.82 and 29.38%

4. The mean and variance of height of 500 students were found to be 165 cm and 25 cm^2 respectively. Find the range of the middle 80% of the students, assuming that the height of the students follows the normal distribution.

Ans: 12.8 cm

5. It is desired to estimate the proportion of the junior executives who changes their first job within first five years. Thus proportion is to be estimate within 3% of error and 0.95 degree of confidence is to be used. A study revealed that 30% of such junior executives changed their first job within 5 years.
   i. How large a sample is required to update the study?
   ii. How large should be the sample if the no such previous estimates are available?

Ans: i. 896 ii. 1067

6. A random sample of size 35 taken from a normal population with standard deviation 5.2 has a mean 81. A second sample of size 36 taken from other normal population with a standard deviation 3.4 has a mean 76. Test whether the two sample means do not test whether the two sample means do not differ significantly.

Ans: 4.8

7. What do you mean by one-way ANOVA? Write and explain the statistical model for it.

8. Two different types of drugs D_1 and D_2 were applied on certain patients for increasing weight at interval of one-week time period. From the following observations obtain t for significance of drugs.

D_1	3	8	12	8	13	9	9	10
D_2	6	11	8	10	12	15	12	12

Ans: t = - 1.208

Group 'C'

Attempt any 'TWO' questions. **[2 × 10 = 20]**

9. A computer manager interested to know how efficiency of his/her computer program which depends on the size of incoming data. Efficiency will be measured by the number of processed requests per hour. In general larger data sets required more computer time and therefore, fewer requests are processed within 1 hour. Applying the program to data sets of different size, the following data were gathered.

Date size (G.B.)	7	10	15	7	6	8	10
Processed requests	50	26	16	55	40	41	17

   i. Identify which one response variable and fit a regression line assuming that the relationship is linear.
   ii. Interpret the regression coefficient with reference to your problem.
   iii. Obtain the coefficient of determination and interpret it.
   iv. Predict the efficiency of new computer for the data size of 12 (GB).

Ans: Y = 72.278 - 4.142X, 0.661, 22.57

10. The distribution of typing mistakes committed by a typist is given below, assuming a Poisson model find out the expected frequencies;

Mistake per page	7	10	15	7	6
Number of pages	50	26	16	55	40

Ans:

Number of typing mistakes	**0**	**1**	**2**	**3**	**4**	**5**
Expected frequency	**147**	**147**	**74**	**25**	**6**	**1**

11. To study the performance of three detergent and three different water temperatures, the following 'whiteness' readings were obtained with specially designed equipments.

Water Temperature	Detergents		
	A	B	C
Cold water	57	55	67
Warm water	49	52	68
Hot water	54	46	58

Test whether there is significant difference in average whiteness due to

i. Difference in water temperature

ii. Difference in detergents, sue 1% level of significance.

Ans: i. F = 2.38, H_0 is accepted; ii. F = 9.85, H_1 is accepted

MODEL SET 5

Group A

Attempt all the questions. **[10×1 = 10]**

1. Circle (O) the correct answer.

i. If X and Y are two independent variables, the value of regression coefficient b_{yx} is equal to:

a) 0 b) 1

c) ∞ d) any positive number

ii. Degree of freedom (d.f) is related to:

a) Number of observations in a set

b) Hypothesis under test

c) Number of independent observation in a set

d) critical value of the test statistics

iii. Statistics deals with

a) Quantities information b) Quantitative information

c) both (a) and (b) d) neither (a) nor (b)

iv. If the grouped data has open end classes, which one cannot be calculated

a) mode b) Median c) quartiles d) Mean

v. A family of parametric distribution, in which mean is equal to the variance?

a) Binomial distribution b) Poisson distribution

c) Normal distribution d) Standard normal distribution

vi. What is the probability that a leap year selected at random contain 53 Saturdays?

a) $\frac{1}{7}$ b) $\frac{53}{365}$ c) $\frac{2}{7}$ d) $\frac{1}{4}$

vii. How large should be the sample size when S is sample S.D., d is margin of error at α level of significance

a) $\frac{S^2Z^2_{\alpha/2}}{d^2}$ b) $\frac{S^2Z^2_{\alpha/2}}{d}$ c) $\frac{SZ^2_{\alpha/2}}{d^2}$ d) $\frac{SZ^2_{\alpha/2}}{d}$

viii. Two-way classification has m rows and n columns that what is degree of freedom for F to test rows?

a) $\{m-1, n-1\}$ b) $\{(m-1), (m-1)(n-1)\}$

c) $\{n-1, m-1\}$ d) $\{m, n\}$

ix. What is the mean of Chi-square distribution?

a) n b) 2n c) $\frac{8}{n}$ d) $\frac{12}{n}$

x. What is standard deviation of sampling distribution?

a) Type-I error b) Type-II error c) Probable error d) Sampling error

Group B

Attempt any SIX the questions. **[6×5 = 30]**

2. State with suitable example the role played by computer technology in applied statistics.

3. From the following distribution of marks of 500 students of a campus, find the minimum pass mark if only 20%, of the students had failed and also find the minimum marks. Obtained by top 25% of the students

Marks	0-20	20-40	40-50	50-60	60-80	80-100
Number of Students	50	100	150	90	60	50

Ans: Minimum pass mark = 30, the minimum marks obtained by top 25% students = 58.

4. An average scanned image occupies 0.6 Megabytes of memory with a standard deviation of 0.4 megabytes. If you plan to publish 80 images on your website, what is the probability that their total size is between 47 megabytes and 50 megabytes? **Ans: 0.035**

5. A car hire firm has two cars that it hires out day by day. The number of demands for a car on each day is distributed as Poisson variate with mean 1.5. Calculate the production of days on which

i. Some demand is refused. ii. neither car is used.

Ans: i. 0.1911; ii. 0.2231

6. Fit a poisson distribution to the following data

Number of defects	0	1	2	3	4
Frequency	11	65	19	3	2

Assuming that the mean of the distribution is 1.2

Ans:

X	0	1	2	3	4
f(x)	30	36	22	9	3

7. Distinguish between census survey and sample survey.

8. the mean breaking strength of cable supplied by a manufacture is 1800 with a standard deviation 100. To test strength of the cables a sample of 50 cable is tested. It is found that the mean breaking strength is 1850. Obtain distribution to test significance of breaking strength of cables. Ans: z = 3.53

Group 'C'

Attempt any TWO questions. **[2 × 10 = 20]**

9. The following tables shows that the number of motor registration and sales of Gorkhali Moter tyres by a wholesale dealer in Kathmandu for the term of 5 years.

Year	2015	2016	2017	2018	2019
Motor Registration (in '000'	60	63	72	75	80
Number of tyres sold (in '000'	125	110	130	135	150

i. Estimate the sale of tyres when expected motor registration in next year is 90,000

ii. Also calculate the correlation coefficient and interpret it.

Ans: i. 159800; ii. 0.85

10. Analysis of the monthly wages paid to workers in two computer shops A and B belonging to the same industry gives the following results.

	Computer Shop A	Computer shop B
Number of wage earners	550	650
Average monthly wages	Rs. 1450	Rs. 1400
Standard deviation of Wages	Rs. 100	Rs. 140

i. Which shop A or B pays out large amount of monthly wages.

ii. In which shop is there a greater variability in individual wages

iii. Calculate the average monthly wages of all workers.

iv. Calculate the variance of wages of all workers.

Ans: i. Shop A; ii. Shop B, iii. 1422.9 iv. 1582.5

11. On a feeding experiment, a farmer has four types of hogs denoted by A, B, C and D. These types are each divided into three groups which are fed on different kinds of rations I, II and III. The following results were obtained, the numbers in the table being the gains in weight (in kg) in the various groups, there being two hugs in each group.

	I	II	III
A	3.0 3.6	6.1 4.9	4.5 5.6
B	7.0 8.2	7.0 6.1	8.5 7.1
C	4.5 6.0	7.0 5.0	4.2 4.0
D	9.0 11.0	14.0 13.0	9.0 10.0

Analyze the data. **Ans: $F_R = 62.31$, $F_C = 5.664$, $F_{intraction} = 2.02$**

MODEL SET 6

Group A

Attempt all the questions. **[10×1 = 10]**

1. Circle (O) the correct answer.

i. Data taken from the publication, "Agricultural situation of Nepal will be considered as.

a) Primary data b) Secondary data

c) Primary and Secondary data d) neither primary nor secondary

ii. The shoe size of most of the people in Nepal is No. 6, which measure of central value does it represents?

a) Mean b) Median c) Mode d) Eighth decile

iii. The relation between the mean and variance of χ^2 with n degree of freedom is,

a) mean = $\frac{1}{2}$ variance b) mean = 2 variance

c) mean = variance d) mean = $2\sqrt{\text{variance}}$

iv. What is the probability that non-leap year selected at random contains 53 Sundays?

a) $\frac{53}{365}$ b) $\frac{1}{4}$ c) $\frac{2}{7}$ d) $\frac{1}{7}$

v. The coordinates $(\overline{X},\overline{Y})$ satisfy the lines of regression of:

a) X on Y b) Y on X
c) both the regression lines. d) None of the regression lines.

vi. Student's t-test is applicable in the case of:

a) Small samples b) For samples of size between 5 and 30
c) Large samples d) For samples of size between 30 and 50

vii. The mean of 10 numbers is 9, then what will be the sum of these numbers?

a) 9 b) 19 c) 90 d) 181

viii. One way classification has 4 rows and 16 observations then what is the degree of freedom for ANOVA?

a) (3, 12) b) (4, 12) c) (12, 16) d) (4, 16)

ix. In a binomial distribution with parameters n = 10 and probability of success in a single trial 0.2 then what will be mean and variance?

a) 2 and 1.6 b) 10 and 0.2 c) 2 and 0.2 d) 10 and 1.6

x How large should the sample size when p is proportion, d is margin of error and α is the level of significance?

a) $\frac{pZ_{\alpha/2}^2}{d^2}$ b) $\frac{q\,Z_{\alpha/2}^2}{d^2}$ c) $\frac{pqZ_{\alpha/2}^2}{d^2}$ d) $pq\frac{Z_{\alpha/2}^2}{d^2}$

Set B

Attempt any SIX the questions. **[6×5 = 30]**

2. What is questionnaire? Describe its characteristics?

3. The following table gives the makes in statistics scored by 10 boys and 8 girls selected randomly from a college appearing in final examination of BCA third semester.

Boys	65	60	70	75	55	45	52	50	48	59
Girls	60	75	66	58	49	50	67	70	-	-

Obtain t for significance. **Ans: t = – 0.87**

4. A researcher wanted to study the relationship between gender and owning cell phone. She took a sample of 2000 adults and obtained the information given in the following table.

	Own all phones	Do not own all phones
Men	640	450
Women	440	470

Obtain χ^2 for significance. **Ans: χ^2 = 21.45**

5. What do you mean by primary data? Describe different methods of Collecting primary data.

6. The combined mean and variance salary of 250 workers of city A and City B are 560 and 5497 respectively. The mean and variance of the salary of 150. workers of city B are 500 and 81 respectively. Find the variance of salary in city A. **Ans: σ^2 (A) = 121.**

7. Microsoft company producing Mother board, there is a small chances of 1/500 being defective. The motherboards are supplied in a packet of 10. Assuming Poisson distribution find the approximate number of packet containing no defective, one defective, two defective and three defective respectively in a consignment of 200 packets. **Ans: 19604, 382, 4, 0**

8. The following table gives the time in hours of 50 students using internet in a week.

Time (in hrs)	Below 10	10-20	20-30	30-40	40-50	50 and above
Number of students	4	6	10	15	8	7

Calculate the average time of using internet in a week. **Ans: M_d = 33.33 hrs.**

Group 'C'

Attempt any TWO questions. **[2 × 10 = 20]**

9. In order to find the correlation coefficient between two variables X and Y from 12 observations, the following calculations are made

$\Sigma X = 30, \Sigma Y = 5, \Sigma X^2 = 670, \Sigma Y^2 = 285$ and $\Sigma XY = 334$

on subsequent deviation it was found that the pair (X = 11, Y = 4) was copied wrongly, the correct value being (X = 10, Y = 14). Find the

i. Correct value of correlation coefficient and interpret it.

ii. also check the significance of r. **Ans: i. r = 0.7757; ii r is high significant.**

10. In a certain area, 8% of the families have their monthly income above Rs. 6400 and 31% of the families have income below 4500. Compute mean and variance of the monthly income of families follow the normal distribution.

Ans: μ = 4997.4, σ^2 = 989556.2

11. Three randomly selected groups of chickens are fed on three different diets. Each group consists of five chickens. Their weight gains during a specified provide of time are as follows.

Diet I	4	4	7	7	8
Diet II	3	4	5	6	7
Diet III	6	7	7	7	8

Test the hypothesis that mean gain of weight due to the three diets are equal.

Ans: F_{Cal} = 2.304, H_0 accepted.

MODEL SET 7

Group A

Attempt all the questions.

1. Circle (O) the correct answer. **[10×1 = 10]**

i. The suitable measure of central tendency of qualitative data is:

a) Mean b) Median
c) Mode d) Standard deviation

ii. If a content value 5 is subtracted from each observations of a set, the variance is:

a) reduce by 5 b) reduced by 25
c) unaltered d) increased by 25

iii. How does sample size and sampling error are related?

a) directly b) inversely
c) positively d) Constantly

iv. How many samples of size 2 can be selected from population of size 4 using simple random sampling without replacement?
a) 2 b) 4
c) 6 d) 8

v. If each value of X is divided by 5 and each value of Y is divided by 10 then the new correlation coefficient r' is:
a) Same as r b) twice of r
c) half of r d) none of above

vi. When degree of freedom for χ^2 are 100 or more Chi-square distribution is approximated to:
a) t-distribution b) F-distribution
c) Z-distribution d) ANOVA test

vii. t-distribution tends to normal distribution when
a) As $n \to 0$ b) As $n \to \infty$
c) As $n \to 1$ d) As $p \to 0$

viii. What is explained variation?
a) Variation between treatment
b) Variation within treatments
c) No variation between treatments
d) No variation with in treatment

ix. For two independent events A and B, $P(A \cap B) = 0.4$ and $P(A) = 0.8$ then what is the value of P (B)?
a) 0.2 b) 0.4
c) 0.32 d) 0.5

x. If Binomial distribution tends to Poisson distribution, what is the mean of Poisson distribution when the mean of Binomial distribution is 25?
a) 12.5 b) 25
c) 50 d) 100

Group B

Attempt any SIX the questions. **[6×5 = 30]**

2. Statistics is the most necessary component for 'Big Data Analysis'. Explain.

3. The arithmetic mean and standard deviation of a series of 20 items were computed as 20 cm and 5 cm respectively. While calculating test, an item 13 cm was misread as 30. Calculate mean and standard deviation when misread item is omitted. **Ans: 19.47, 4.57**

4. The following information gives the age of husband (X) and wife (Y) for married couples living together.
   i. Calculate the correlation coefficient between the age of husband and that of his wire and interpret it.
   ii. Test the significance of r and interpret it.
   iii. Also find the limits for the expected age of wife for their husbands. Where, $N = \Sigma f = 72$, $\Sigma fX = 3560$, $\Sigma fX^2 = 196800$, $\Sigma fY = 3260$, $\Sigma fY^2 = 168400$ and $\Sigma fXY = 172000$.

   Ans: i. r = 0.52; ii. r is significant; iii. (0.46, 0.58)

5. The advertisement expenses and the sales of a new product are recorded as below:

Advertisement expenditure (in Rs. 000)	1	5	6	8	10
Sales (in Rs. '000')	50	60	80	100	100

Estimate the sales when the advertisement expenses is Rs. 15000. **Ans: 144557**

6. Fit the Binomial distribution for the following data.

Number of Success	0	1	2	3	4	5

Frequency	150	500	960	900	500	190

Assume the probability of success in each case is 0.5.

Ans:

X	0	1	2	3	4	5
f(r)	100	500	1000	1000	500	100

7. Differentiate between sampling and non-sampling error?
8. In a sample of 20 observations drawn from a bi-variate normal population, a correlation coefficient is found to be 0.63. Obtain Z for significance of sample correlation coefficient from population correlation coefficient of 0.55? **Ans: Z = 0.5**

Group 'C'

Attempt any TWO questions. **[2 × 10 = 20]**

9. Following are the marks obtained by two BCA students in 10 tests of 60 marks each.

Tests	1	2	3	4	5	6	7	8	9	10
Marks secured by A	24	37	27	30	31	34	36	26	29	33
Marks secured by A	22	40	38	24	26	36	34	28	30	27

i. If the consistency of performance is the criterion the awarding a prize. Who should be awarded by the prize?
ii. Who is better?
iii. Who is intelligent?

Ans: i. Mr. A; ii. Mr. B; iii. Mr. A

10. Fit Normal distribution to the following data and find expected frequencies.

Class	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
frequency	1	3	16	34	28	14	3	1

Ans: 0.67, 4.61, 16.39, 30.27., 29.1, 14.57, 3.97, 0.51

11. Set up a two-may ANOVA table for the data given below related to yield of crop:

Workers	Machine Types			
	A	B	C	D
I	44	38	47	36
II	46	40	52	43
III	34	36	44	32
IV	43	38	46	33
V	38	42	49	39

i. Test mean productivity is same for the four different machine types.
ii. Test whether five workers differ with respect to mean productivity.

Ans: i. $F_c = 18.39$, H_1 is accepted; ii. $F_R = 6.58$, H_1 is accepted.

MODEL SET 8

Group A

Attempt all the questions. **[10×1 = 10]**

1. Circle (O) the correct answer.

i. Probable error is used for
   a) measuring the error in r
   b) Testing the significance of r
   c) Determining the limits for population correlation
   d) Both (b) and (c)

ii. The range of the variance ratio F is:
   a) 0 to 1
   b) 0 to ∞
   c) - 1 to 1
   d) - ∞ to ∞

iii. The first quartile divides a frequency distribution

a) 4:1 b) 1:4

c) 3:1 d) 1:3

iv. Which measures of dispersion ensure highest degree of reliability?

a) Range b) Mean deviation

c) Standard deviation d) Quartile deviation

v. How many samples of size 2 can be selected from population of size 5 using simple random sample with replacement?

a) 2 b) 5

c) 10 d) 25

vi. What is distribution of $\dfrac{p - P}{\sqrt{\left(\dfrac{N-n}{N-1}\right)\dfrac{PQ}{n}}} = ?$

a) Z b) t

c) χ^2 d) F

vii. What is called total squared residual?

a) Sum of square of error b) Standard error of estimate

c) mean sum of square of error d) Probable error

viii. What is probability mass function of Poisson

a) $\dfrac{e^{-\lambda}.x^{\lambda}}{x!}$ b) $\dfrac{e^{-x}.x^{\lambda}}{x!}$

c) $\dfrac{e^{-\lambda}.\lambda^{x}}{x!}$ b) $\dfrac{e^{-\lambda}.x^{\lambda}}{x!}$

ix. If covariance between X and Y is 30, Variance of X is 49 and variance of Y is 100 then what is correlation coefficient between X and Y?

a) $\dfrac{3}{7}$ b) $\dfrac{3}{10}$

c) $\dfrac{30}{49}$ d) $\dfrac{7}{10}$

x. What is formula to obtain variance of two series combined together?

a) $\dfrac{n_1\sigma_1^2 + n_2\sigma_2^2}{n_1 + n_2}$ b) $\dfrac{n_1\left(\sigma_1^2 + d_1^2\right) + n_2\left(\sigma_2^2 + d_2^2\right)}{n_1 + n_2}$

c) $\dfrac{n_1\sigma_1^2 - n_2\sigma_2^2}{n_1 + n_2}$ d) $\dfrac{n_1\left(\sigma_1^2 - d_2^1\right) + n_2\left(\sigma_2^2 - d_2^1\right)}{n_1 + n_2}$

Group B

Attempt any SIX the questions. **[6×5 = 30]**

2. Estimate the most likely demand when the price is Rs. 20 from the given data:

Price (in Rs.)	10	12	13	12	16	15
Amount demand	40	38	43	45	37	43

Obtain correlation coefficient and coefficient of determinant. Also interpret the result.

Ans: $Y_e = 39.25$, $r = -0.173$, $r^2 = 0.03$

3. 10 percent of the workers in a firm employing a total of 1,000 workers earn less than Rs. 5 per day, 200 earn between Rs. 5-9.99, 30 percent between 10-14.99, 250 workers between 15-19.99 and rest 20 and above. What is the median wage? **Ans: Rs. 13.33**

4. Fit a Poisson distribution to the following data.

Number of defects	0	1	2	3	4
Frequency	11	65	19	3	2

Ans:

X	0	1	2	3	4	Total
f(r)	30	36	22	9	3	100

5. Differentiate between parameter and statistics.

6. Describe different sources of secondary data. State the problems arises while collecting secondary data.

7. The average marks secured in BCA exam in the year 2019 by college A and College B are 78 and 80 with variance 100 and 81 respectively. The number of students appeared in the BCA exam from college A is 100 and college B is 150. Compute the mean and standard deviation of marks secured by the two college of students taken together. **Ans: 79.2 and 9.46**

8. The following table shows the frequency distribution of DELL laptops sold at a computer shop during the past 10 months.

Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Laptop sold	23	17	15	10	14	12	13	15	26	25

obtain χ^2 for significance. **Ans: $\chi^2 = 16.94$**

Group 'C'

Attempt any TWO questions. **[2 × 10 = 20]**

9. A computer while calculating the correlation coefficient obtained the following results;

$\Sigma X = 562$, $\Sigma X^2 = 39602$, $\Sigma Y = 561$, $\Sigma Y^2 = 39815$ and $\Sigma XY = 39441$

It was how ever later discovered at the time of checking that the computer had copied down two pairs as (X = 65, Y = 56) and (X = 76, Y = 86) while the correct values were (X = 67, Y = 65) and (X = 67, Y = 68)

i. Calculate the correct correlation coefficient.

ii. Test the significance of r

iii. Estimate the value of Y when X = 65.

Ans: i. r = 0.6; ii. nothing can be concluded; iii. $Y_e = 67$

10. Of a large group of men 5% are under 60 inches in height and 40% are between 60 and 65 inches. Assuming a normal distribution, find the mean height and standard deviation.

Ans: $\mu = 65.43, \sigma = 3.31$

11. Four trained operator work in four machines in production of a new product. The productivity of the operators and machine are recorded as below.

Operators	Machine			
	1	2	3	4
1	10	12	14	16
2	12	11	13	16
3	14	15	12	11
4	16	10	17	17

Test whether difference in average productivity is due to the difference is operators and machines.

Ans: i. $F = 0.62$ H_0 is accepted ii. $F = 1.03$ H_0 is accepted

Answer Key

Set - 1				
i. (b)	ii. d	iii. 7b	iv. (d)	v. c
vi. (b)	vii. c	viii. a	ix. d	x. b
Set – 2				
i. d	ii. a	iii. b	iv. c	v. c
vi. d	vii. b	viii. a	ix. c	x. b
Set – 3				
i. d	ii. c	iii. b	iv. d	v. d
vi. a	vii. c	viii. b	ix. a	x. c
Set – 4				
i. a	ii. b	iii. a	iv. c	v. b
vi. d	vii. c	viii. d	ix. a	x. b
Set – 5				
i. a	ii. c	iii. b	iv. d	v. b
vi. c	vii. a	viii. b	ix. a	x. d
Set – 6				
i. b	ii. c	iii. a	iv. d	v. c
vi. b	vii. c	viii. a	ix. a	x. d
Set – 7				
i. b	ii. c	iii. b	iv. c	v. a
vi. c	vii. b	viii. a	ix. d	x. b
Set – 8				
i. d	ii. b	iii. d	iv. c	v. d
vi. a	vii. a	viii. c	ix. d	x. b

□□□