CHAPTER-13
STRUCTURES
SHORT ANSWER QUESTIONS

1. **Discuss the similarity and differences of a structure as compared to an array and a class.**

Ans.

Similarities

array and Structure
✓ Both structures and arrays are used to hold more than 1 elements under single name.

Difference

array	structure
✓ Arrays bring together a group of items of the same data type	✓ Structures bring together a group of related data items of any data type.

Similarities

class and structure
✓ Both Class and Structures can have methods, variables and objects. ✓ Both can have constructor. ✓ Both are user defined types.

Difference

class	structure
✓ Declared with the keyword "class"	✓ Declared with the keyword "struct"
✓ By default, all members are "private" in a class	✓ By default, all members are "public" in a structure

2. **Define a structure to store information about a fish. The structure should include the kind, the weight in grams, and the length in inches. Declares variables of this structure type and discuss various methods of initializing them.**

Ans.

```
struct Fish_Info
{
        char kind[50];
        int gram;
        int length;
};
Fish_Info fish;
```

first method of initializing

The structure elements of a structure can be initialized separately, using separate assignment statement.

```
fish.kind="abc";
fish.gram=300;
fish.length=5;
```

second method of initializing

The structure element of a structure can be initialized jointly, using the notation similar to array initialization.

```
Fish_Info fish = { "abc", 300, 5);
```

3. **Write definition for a structure EMPREC that stores information about an employee such as empno, name, address, salary, and joining_date. The address member of EMPREC stores the information houseno, area, and city. The joining_date member of EMPREC stores information day, month, and year.**

Ans.

```
struct date
{
      int day;
      int month;
      int year;
};
struct addr
```

```
{
      int houseno;
      char area[31];
      char city[31];
};
struct EMPREC
{
      int empno;
      char name[41];
      addr address;
      float salary;
      date joining_date;
};
```

4. **What is structure? Declare a structure in C++ with name, roll number and total marks as components.**

Ans. A structure is a collection of variables having different data types.
The declaration as:

```
struct student
{
        char name[20];
        int roll_no,marks;
};
```

5. **Rewrite the following program after removing the syntactical error(s), if any. Underline each correction.**

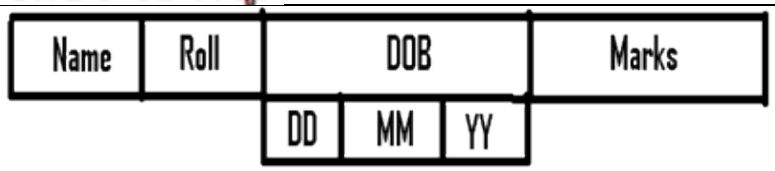
```
#include<iostream.h>
int main( )
{   struct STUDENT
   {    char stu_name[20];
        char stu_sex;
        int stu_age=17;
   }student;
   gets(stu_name);
   gets(stu_sex);
   return 0;
}
```

Ans.

```
#include<iostream.h>
#include<stdio.h>
int  main( )
{     struct STUDENT
      {  char stu_name[20];
         char stu_sex;
         int stu_age;
         //Initialization of variables inside a structure is not allowed.
      }student;
      gets(student.stu_name);
      cin>>student.stu_sex;
      //A single character cannot be read using gets
       return 0;
}
```

6. **What are Nested Structures? Give an example.**

Ans. Nested structures are structures as member of another structure. For example,the date of birth is astructure within the structure of a student as shown below. These types of structures are known as nested structures.



Example: -

```
#include< iostream.h>
struct course
 {
   int couno;
   int coufees;
 };
struct student
 {
   int studno;
   course sc;
   course sc1;
  };
void main( )
{
  student s1;
  s1.studno=100;
  s1.sc.couno=123;
  s1.sc.coufees=5000;
  s1.sc1.couno=200;
  s1.sc1.coufees=5000;
  int x = s1.sc.coufees + s1.sc1.coufees;
  cout<< “endl Student Number: ”<< s1.studno<< ”endl Total Fees: Rs.”<< x;
 }
```

The output of the above program is

Student Number: 100
Total Fees: Rs.10000

7. **Rewrite the corrected code for the following program. Underline each correction (if any).**

```
#include<iostream.h>
structure Swimmingclub
{
        int mem number;
        char memname[20];
        char memtype[]=”LIG”;
};
int main( )
{
        Swimmingclub per1,per2;
        cin>>”Member Number: “;
        cin>>memnumber.per1;
        cout<<”Member Name: “;
        cin>>per1.membername;
        per1.memtype = “HIG”;
        per2=per1;
        cin>>”Member Number;“ <<per2.memnumber;
        cin<<”Member Name” <<per2.memname;
```

```
        cin<<"Member Number:"<<per2.memtype;
        return 0;
}
```

Ans.

```
#include<iostream.h>

#include<string.h>
struct Swimmingclub
{
        int memnumber;
        char memname[20];
        char memtype[4];
};
int main( )
 {
        Swimmingclub per1,per2;
        cout>>"Member Number: ";
        cin>>per1.memnumber;
        cout<<"Member Name: ";
        cin>>per1.memname;
        strcpy(per1.memtype, "HIG");
          per2=per1;
          cout>>"Member Number;" <<per2.memnumber;
          cout<<"Member Name" <<per2.memname;
          cout<<"Member Number:"<<per2.memtype;
          return 0;
}
```

8. Identify and discuss the error(s) in the following code fragment:

```
#include<iostream.h>
struct s1
{
        int a;
        float b;
        char c;
}       st1,st2,st3;
int main()
{
        struct s2{
                        int x;
                        float y;
                        char z;
                }       ss1,ss2,ss3;
                // Read & Initialize structures
                ss2=ss1;
                :
                ss3.z=st1.c;
                  :
}
void func1()
{
        ss2.x=st1.a;
        ss3.y=st2.b;
        ss1.z=st3.c;
```

	: **ss1=ss3;** **}** **Suggest way(s) to rectify the errors.**

Ans.	#include<iostream.h>
	struct s1
	{
	int a;
	float b;
	char c;
	}st1,st2,st3;
	int main()
	{
	struct s2{
	int x;
	float y;
	char z;
	}ss1,ss2,ss3;
	// Read & Initialize structures
	ss2=ss1;
	:
	ss3.z=st1.c;
	:
	}
	void func1()
	{
	ss2.x=st1.a;
	ss3.y=st2.b;
	ss1.z=st3.c;
	:
	ss1=ss3;
	}
	The error points mentioned in this answer is depend on the compiler, as we are using stone age compiler this may give compilation the error, but the ss3 will show error in all complier because ss3 is not declare inside func1().

9.	**Write a code fragment to declare and read in values (from user) for an array ARR of size 10 whose elements consists of name, category, Marks in 5 subjects and registration number. The category can be one of Gen, SC, ST, and OBC. The registration number is a combination of areacode, region code, school code, current year (yy) and a serial number.**

Ans.	`#include<iostream.h>`
	`#include<conio.h>`
	`#include<stdio.h>`
	`struct rege_num`
	`{`
	`int areacode;`
	`int region_code;`
	`int school_code;`
	`int current_year;`
	`int serial_number;`
	`};`
	`struct info`
	`{`
	`char name[50];`
	`char category[10];`
	`int marks[5];`

```
      rege_num regno;
};
info arr[10];
void main()
{
      int i,j;
      clrscr();
      for(i=0;i<10;i++)
      {
            cout<<"Enter name =";
            gets(arr[i].name);
            cout<<"Enter one of gen,sc,st or obc category =";
            gets(arr[i].category);
            for(j=0;j<5;j++)
            {
                  cout<<"enter marks"<<j+1<<" = ";
                  cin>>arr[i].marks[j];
            }
            cout<<"enter areacode =";
            cin>>arr[i].regno.areacode;
            cout<<"enter region code =";
            cin>>arr[i].regno.region_code;
            cout<<"enter school code =";
            cin>>arr[i].regno.school_code;
            cout<<"enter current year =";
            cin>>arr[i].regno.current_year;
            cout<<"enter serial number =";
            cin>>arr[i].regno.serial_number;
      }
      cout<<"******************  student info ******************"<<endl;
      for(i=0;i<10;i++)
      {
            cout<<"Name :"<<arr[i].name<<endl;
            cout<<"category :"<<arr[i].category<<endl;
            for(j=0;j<5;j++)
            {
                  cout<<"marks"<<j+1<<" = "<<arr[i].marks[j]<<endl;
            }
            cout<<"Registration Number
:"<<arr[i].regno.areacode<<arr[i].regno.region_code<<arr[i].regno.school_code<<a
rr[i].regno.current_year<<arr[i].regno.serial_number<<endl;
      }
      getch();
}
```

10. **Give appropriate declaration to store 10 records where each record store the following information:**
Authorno, Authorname,
book_list containing information of 5 books.
The book-list stores the following information:
bookno, bookname, subject, price, edition, and publication.
The publication stores the following information:
proprietor-name, publishing company's name, address, and phone-number.

Ans.

```
struct publication
{
      char proprietor_name[50];
      char company_name[50];
      char address[50];
```

```
      int phone_no;
};
struct book_list
{
      int bookno;
      char bookname[50];
      char subject[20];
      float price;
      char edition[10];
      publication public[20];
};
struct book_info
{
      int authorno;
      char author_name[50];
      book_list book[5];
};
```

11. **Write a code fragment to read in values for the first record of array mentioned in question 10.**

Ans.

```
#include<iostream.h>
#include<conio.h>
#include<stdio.h>
struct publication
{
      char proprietor_name[50];
      char company_name[50];
      char address[50];
      int phone_no;
};
struct book_list
{
      int bookno;
      char bookname[50];
      char subject[20];
      float price;
      char edition[10];
      publication pub;
};
struct book_info
{
      int authorno;
      char author_name[50];
      book_list bookl[5];
};
book_info book[2];
void main()
{
      int i,j;
      clrscr();
      for(i=0;i<2;i++)
      {
            cout<<"enter author no =";
            cin>>book[i].authorno;
            cout<<"enter author name =";
            gets(book[i].author_name);
            for(j=0;j<2;j++)
            {
                  cout<<"enter book no =";
```

```
                cin>>book[i].bookl[j].bookno;
                cout<<"enter book name =";
                gets(book[i].bookl[j].bookname);
                cout<<"enter subject =";
                gets(book[i].bookl[j].subject);
                cout<<"enter price =";
                cin>>book[i].bookl[j].price;
                cout<<"enter edition =";
                gets(book[i].bookl[j].edition);
                cout<<"enter proprietor name =";
                gets(book[i].bookl[j].pub.proprietor_name);
                cout<<"enter publiching company's name =";
                gets(book[i].bookl[j].pub.company_name);
                cout<<"enter address =";
                gets(book[i].bookl[j].pub.address);
                cout<<"enter phone number =";
                cin>>book[i].bookl[j].pub.phone_no;
          }
     }
     clrscr();
     //read data
     cout<<"*************** BOOK INFORMATION *****************"<<endl;
     for(i=0;i<2;i++)
     {
          cout<<" author no ="<<book[i].authorno<<endl;
          cout<<"author name ="<<book[i].author_name<<endl;
          cout<<" BOOK LIST"<<endl;
          for(j=0;j<2;j++)
          {
                cout<<"book no ="<<book[i].bookl[j].bookno<<endl;
                cout<<"book name ="<<book[i].bookl[j].bookname<<endl;
                cout<<"subject ="<<book[i].bookl[j].subject<<endl;
                cout<<"price ="<<book[i].bookl[j].price<<endl;
                cout<<"edition ="<<book[i].bookl[j].edition<endl;
                cout<<"PUBLICATION"<<endl;
                cout<<"proprietor name
="<<book[i].bookl[j].pub.proprietor_name<<endl;
                cout<<"publiching company's name
="<<book[i].bookl[j].pub.company_name<<endl;
                cout<<"address ="<<book[i].bookl[j].pub.address<<endl;
                cout<<"phone number ="<<book[i].bookl[j].pub.phone_no<<endl;
          }
     }
     getch();
}
```

12. **Write a function that accepts a date type structure and returns a date 50 days after it.**

Ans.

```
struct date
{
   int dd;
   int mm;
   int yy;
 };
date modify(date d1,int add=50)
 {
   int d= d1.dd+50;
   d1.dd=d%30;
```

```
   int m = d1.mm+(d/30);
   d1.mm=m%12;
   d1.yy += (m/12);
   if(d1.dd= =0)
    {
      d1.dd=12;
      --d1.mm;
    }
   if(d1.mm< =0)
    {
      d1.mm=30;
      --d1.yy;
    }
   return(d1);
 }
```

13. **Predict the output of the following code (Assuming that required header files have been included):**

```
struct Time
{
        int hour, minutes, seconds;
};
void updatetime(Time new_time)
{
        ++new_time.seconds;
        if(new_time.seconds==60)
        {
                new_time.seconds=0;
                ++new_time.minutes;
        }
        if(new_time.minutes==60)
        {
                new_time.minutes=0;
                ++new_time.hour;
        }
        if(new_time.hour==24)
                new_time.hour=0;
}
int main()
{
        Time cur_time;
        cout<<"Enter the time(hh:mm:ss:):\n";
        cin>>cur_time.hour>>cur_time.minutes>>cur_time.seconds;
        updatetime(cur_time);
        cout<<"New time is"<<cur_time.hour<<":"<<cur_time.minutes<<":"<<cur_time.seconds<<endl;
        return 0;
}
```

Ans.

```
C:\TC\BIN>tc.exe
Enter the time(hh:mm:ss:):
2
4
5
New time is2:4:5
```

14. **Find the output of the following program:**

```
#include<iostream.h>
struct Package
{
        int Length,Breadth,Height;
};
void Occupies(Package M)
{
        cout<<M.Length<<"x"
        <<M.Breadth<<"x" ;
        cout<<M.Height<<endl;
}
int main( )
{
        Package P1={100,150,50},P2,P3;
        ++P1.Length;
        Occupies(P1);
        P3=P1;
        ++P3.Breadth;
        P3.Breadth++;
        Occupies(P3);
        P2=P3;
        P2.Breadth+=50;
        P2.Height--;
        Occupies(P2);
        return 0;
}
```

Ans.

```
C:\TC\BIN>tc.exe
101x150x50
101x152x50
101x202x49
```

15. Give the output of the following program:

```
#include<iostream.h>
struct Pixel
{
        int C,R;
};
void Display(Pixel P)
{
        cout<<"col"<<P.C<<"Row"<<P.R<<endl ;
}
int main( )
{
        Pixel X={40,50},Y,Z;
        Z=X;
        X.C+=10;
        Y=Z;
        Y.C+=10;
        Y.R+=20;
        Z.C-=15;
        Display(X);
        Display(Y);
        Display(Z);
        return 0;
```

}

Ans.

```
C:\TC\BIN>tc.exe
col50Row50
col50Row70
col25Row50
```

16. **What will the output of the following code, if the input entered is:**
1.9, 2.1, -3.4, 2.1, 2.2, -4.5, 3.2, 2.6, 2.9, 23.1, -4.4, 3.1, 3.2, -3.5, 2.2, 1.6

```
#define LOOPS 4
typedef struct imaginary_number
{
        double real_part;
        double imag_part;
}IMAG_NUM;
typedef struct imag_rect
{
        IMAG_NUM corner1;
        IMAGE_NUM corner2;
}IMAG_RECT;
IMAG_RECT Rect[3];
Rect[i].corner1.imag_part=3.1;
Rect[i].corner1.real_part=1.2;
Rect[i].corner2.imag_part=-2.3;
Rect[i].corner2.real_part=1.4;
int main()
{
        int i,j;
        for(i=1;i<LOOPS;i++)
        {
                cin>>Rect[i].corner1.imag_part;
                cin>>Rect[i].corner1.real_part;
                cin>>Rect[i].corner2.imag_part;
                cin>>Rect[i].corner2.real_part;
        }
        for(i=0;i<LOOPS;i++)
        {
                cout<<Rect[i].corner1.real_part<<"+"<<Rect[i].corner1.imag_part<<"i"<<endl;
                cout<<Rect[i].corner2.real_part<<"+"<<Rect[i].corner2.imag_part<<"i"<<endl; m,/.
        }
        return 0;
}
```

Ans. Above code is totally garbage with lots of error and confusing piece of code.

```
IMAGE_NUM corner2;              //Incorrect structure name
IMAG_RECT Rect[3];              //Wrong number of elements defined
Rect[i].corner1.imag_part=3.1;  //[i] from where this i is coming not defined and declared.
Rect[i].corner1.real_part=1.2;  //[i] from where this i is coming not defined and declared.
Rect[i].corner2.imag_part=-2.3; //[i] from where this i is coming not defined and declared.
Rect[i].corner2.real_part=1.4;  //[i] from where this i is coming not defined and declared.
for(i=1;i<LOOPS;i++)            //incorrectly loop initialized

m,/.                            //ambiguous  code
```

If we change the code like this –

```
#include <iostream.h>
#include <conio.h>
```

```
#define LOOPS 4
typedef struct imaginary_number
{
        double real_part;
        double imag_part;
}IMAG_NUM;
typedef struct imag_rect
{
        IMAG_NUM corner1;
        IMAG_NUM corner2;
}IMAG_RECT;
IMAG_RECT Rect[4];
int main()
{
        int i,j;
        clrscr();
        for(i=0;i<LOOPS;i++)
        {
                cin>>Rect[i].corner1.imag_part;
                cin>>Rect[i].corner1.real_part;
                cin>>Rect[i].corner2.imag_part;
                cin>>Rect[i].corner2.real_part;
        }
        for(i=0;i<LOOPS;i++)
        {
                cout<<Rect[i].corner1.real_part<<"+"<<Rect[i].corner1.imag_part<<"i"<<endl;
                cout<<Rect[i].corner2.real_part<<"+"<<Rect[i].corner2.imag_part<<"i"<<endl;
                count<<endl;
        }
        return 0;
}
```

And after entering numbers mentioned in question, output will be –

```
2.1+1.9i
2.1+-0.34i

-4.5+2.2i
2.6+3.2i

23.1+2.9i
3.1+-4.4i

-3.5+3.2i
1.6+2.2i
```

LONG ANSWER QUESTIONS

1.	**Declare a structure to represent a complex number (a number having a real and imaginary part). Write C++ function to add, subtract, multiply and divide two complex numbers.**
Ans.	

```
#include<conio.h>
#include<iostream.h>
struct complexNo
{
      float real;
      float img;
};
typedef complexNo cm;
void main()
```

```
{
      cm n1,n2,res;
      cout<<"\nEnter 2 complex nos:";
      cout<<"\n\n Enter 1st No.:";
      cout<<"\n Real = ? ";
      cin>>n1.real;
      cout<<"\n Imaginary = ? ";
      cin>>n1.img;
      cout<<"\n Enter 2st No.:";
      cout<<"\n Real = ? ";
      cin>>n2.real;
      cout<<"\n Imaginary = ? ";
      cin>>n2.img;
      res.real = n1.real +n2.real;
      res.img = n1.img + n2.img;
      cout<<"\n Sum of " << n1.real << " + i " << n1.img << " & " << n2.real <<
" +i " << n2.img << "is "<< res.real << " + i " <<res.img;
      res.real = n1.real -n2.real;
      res.img = n1.img - n2.img;
      cout<<"\n Diff. of " << n1.real << " + i " << n1.img << " & " << n2.real
<< " +"<< res.img;
      res.real = n1.real *n2.real;
      res.img = n1.img *n2.img;
      cout<<"\n Product of " << n1.real << " + i " << n1.img << " & " << n2.real
<< " +i " << n2.img << "is "<< res.real << " + i "<< res.img;
      res.real = n1.real / n2.real;
      res.img = n1.img / n2.img;
      cout<<"\n Result od dividing of " << n1.real << " + i " << n1.img << " by
" << n2.real << " +i " << n2.img << "is "<< res.real << " + i "<< res.img;
      getch();
}
```

2. **Write a program to record score of a cricket match. One array stores information of batting team such as batsman's name, runs scored, indication if out, mode by which out along with total runs, overs played, total overs and extras. The other array stores information about bowling team such as bowler's name, overs bowled, maiden overs, runs given, and wicked taken. The program reads in the above information and depending upon the user's choice, it displays either the batting team's information or the bowling team's information.**

Ans.

```
#include<iostream.h>
#include<conio.h>
#include<stdio.h>
struct batting
{
     char batsman[20];
     int run;
     char out;
     int tot_run;
     int overs;
     int total_over;
     int extra;
};
struct bowling
{
     char bowler[20];
     int overs;
     int maiden_overs;
```

```
     int runs;
     int wicket;
};
void main()
{
  batting bat_team[12];
  bowling bo_team[12];
  cout<<"\n Enter records of batting team :\n\n";
  for(int i =0; i < 12 ; i++)
  {
    cout<<"\n Enter bat's man name :";
    gets(bat_team[i].batsman);
    cout<<"\n Enter run scored :";
    cin>>bat_team[i].run;
    cout<<"\n Type 0 NOT-OUT , Type 1 if OUT :";
    cin>>bat_team[i].out;
    cout<<"\n Enter total run :";
    cin>>bat_team[i].tot_run;
    cout<<"\n Enter no. of overs played :";
    cin>>bat_team[i].overs;
    cout<<"\n Enter total over:";
    cin>>bat_team[i].total_over;
    cout<<"\n Extra ?";
    cin>>bat_team[i].extra;
  }
  cout<<"\n Enter records of bowling team :\n\n";
  for( i = 0; i < 12 ; i++)
  {
     cout<<"\n Enter bowler's name :";
     gets(bo_team[i].bowler);
     cout<<"\n Enter overs bowled :";
     cin>>bo_team[i].overs;
     cout<<"\n Enter maiden overs :";
     cin>>bo_team[i].maiden_overs;
     cout<<"\n Enter runs :";
     cin>>bo_team[i].runs;
     cout<<"\n Enter wicked taken:";
     cin>>bo_team[i].wicket;
  }
  char ch;
  int n;
  do
  {
   clrscr();
   cout<<"\n Enter 1 to view batting team information:";
   cout<<"\n Enter 2 to view bowling team information:";
   cout<<"\n Enter your choice :";
   cin>>n;
   switch(n)
   {
    case 1:
     cout<<"\n ************* BATTING TEAM *************\n";
     cout<<"\n Name \t RUN-Scored Out Total-run Over's-played Total-Overs Extra
";
     for( i = 0; i < 12 ; i++)
     {
        cout<<"\n"<< bat_team[i].batsman <<"\t"<< bat_team[i].run<<" ";
```

```
       if(bat_team[i].out)
          cout<<"OUT";
       else
          cout<<"NOT-OUT";
      cout<< " " <<   bat_team[i].tot_run<< " " << bat_team[i].overs << " " <<
bat_team[i].total_over<<  " "<< bat_team[i].extra;
     }
     break;
     case 2:
      cout<< "\n ************* BOWLING TEAM *************\n";
      cout<< "\n Name \t Overs_bowled Maiden-Overs Runs-Given Wicket-Taken ";
      for( i = 0; i < 12 ; i++)
     {
      cout<<  "\n"<< bo_team[i].bowler<< "\t"<< bo_team[i].overs<< " ";
      cout<< " "<< bo_team[i].maiden_overs<< " "<< bo_team[i].runs<< " "<<
bo_team[i].wicket<<" ";
     }
     break;
     default:
        cout<< "\n Wrong choice.";
     }
     cout<<"\n Do you continue (y/n)";
     cin>>ch;
   }while((ch=='y')||(ch=='Y'));
   getch();
}
```

3. **Given the following structure :**

```
struct info
{
        float hra_rate, da_rate, cca, pf_rate, it_rate;
        int days_worked;
};
struct emp
{
         int empno;
         char name[21];
         float basic;
         info others;
} salemp, puremp, imemp;
```

Using the information stored in others member of emp, calculate the Gross and Net Salary of an employee. The Gross Salary is calculated as follows :

(basic x days _ worked) /26 + (basic x hra _ rate)/100 + (basic x da _rate)/100 +cca

The Net Salary is calculated as follows :

Gross_Salary – ((basic x it _rate) /100 + (basic x pt _rate)/100)

Ans.

```
#include<iostream.h>
#include<conio.h>
#include<stdio.h>
struct info
{
     float hra_rate, da_rate, cca, pf_rate, it_rate;
     int days_worked;
};
struct emp
{
```

```
      int empno;
      char name[21];
      float basic;
      info others;
} salemp, puremp, imemp;
void main()
{
      float gs, ns;
      clrscr();
      cout<<"\n Enter Records for Sale Emp :";
      cout <<"\n Enter EmpNo, EmpName, Basic Pay, HRA-rate, DA-rate, CCA-rate,
PF-rate, IT-rate, Days of Work :";
      cin >> salemp.empno;
      gets(salemp.name);
      cin>> salemp.basic>> salemp.others.hra_rate >> salemp.others.da_rate >>
salemp.others.cca >> salemp.others.pf_rate >> salemp.others.it_rate;
      gs = (salemp.basic * salemp.others.days_worked) /26  + (salemp.basic *
salemp.others.hra_rate)/100 + (salemp.basic * salemp.others.da_rate)/100 +
salemp.others.cca;
      ns = gs-((salemp.basic * salemp.others.it_rate)/100 +(salemp. basic *
salemp.others.pf_rate)/100);
      cout<<"\nEmpNo.\tName\tThe Gross salary (Rs.)\t The Net Salary (Rs).";
      cout<<"\n"<< salemp.empno << "\t" << salemp.name<<"\t"<<"\t"<< gs << ns;
      cout<<"\n****************************************";
      cout<< "\n Enter Records for Purchase Emp :";
      cout <<"\n Enter EmpNo, EmpName, Basic Pay, HRA-rate, DA-rate, CCA-rate,
PF-rate, IT-rate, Days of Work :";
      cin >> puremp.empno;
      gets(puremp.name);
      cin>> puremp.basic>> puremp.others.hra_rate >> puremp.others.da_rate >>
puremp.others.cca >> puremp.others.pf_rate >> puremp.others.it_rate;
      gs = (puremp.basic * puremp.others.days_worked) /26  + (puremp.basic *
puremp.others. hra_rate)/100 + (puremp.basic * puremp.others.da_rate)/100 +
puremp.others.cca;
      ns = gs - ((puremp.basic * puremp.others.it_rate)/100 +( puremp.basic *
puremp.others.pf_rate)/100);
      cout<< "\nEmpNo.\tName\tThe Gross salary (Rs.)\t The Net Salary (Rs).";
      cout<<"\n"<< salemp.empno << "\t" << salemp.name<<"\t"<<"\t"<< gs << ns ;
      cout<<"\n****************************************";
      getch();
}
```

4. **A phone number such as (011)711 8802 can be thought of as having three parts: the area code(011), the exchange(711), and the number(8802). Write a program that uses a structure to store these three parts of a phone number separately. Call the structure phone. Create an array to store 20 records of its member wherein each record stores the member no., member name and phone number of phone type. Have the user input the information for all records and then display the entire information on the screen.**

Ans.

```
#include<iostream.h>
#include<conio.h>
#include<stdio.h>
struct phone
```

```
{
      int area_code;
      int exchange;
      int number;
};
struct member
{
      int member_id;
      char name[30];
      phone ph_no;
};
void main()
{
      member rec[20];
      char ch;
      int i;
      cout<<"\n Enter records of 20 members ";
      for(i = 0; i < 20 ; i++)
      {
            cout<< "\n Member ID ? ";
            cin >> rec[i].member_id;
            cout<< "\n Enter Name :";
            gets( rec[i].name);
            cout<< " \n Enter phone number in the format \'areacode - exchange -
number (003 - 2442 - 6523)\' :";
            cin >> rec[i].ph_no.area_code >> ch >>  rec[i].ph_no.exchange >> ch
>> rec[i].ph_no.number ;
      }
      clrscr();
      cout<< "\n Member ID \t Member Name \t Ph. No. \n ";
      cout<< "-----------------------------------------\n\n";
      for(i = 0; i < 20 ; i++)
      {
            cout<< rec[i].member_id << "\t" << rec[i].name << "\t" <<
rec[i].ph_no.area_code<< "-" <<  rec[i].ph_no.exchange <<  "-" <<
rec[i].ph_no.number << endl ;
      }
      getch();
}
```

5. **Create a structure called volume that uses three variables (length, width, height) of type distance (feet and inches) to model the volume of a room. Read the three dimensions of the room and calculate the volume it represents, and print out the result. The volume should be in cu. feet form, i.e., you will have to convert each dimension in to feet and fractions of foot. For instance, the length 12 feet 6 inches will be 12.5 feet.**

Ans.

```
#include<iostream.h>
#include<conio.h>
struct vol
{
      int l_in_feet, b_in_feet, h_in_feet;
      int l_in_inch, b_in_inch, h_in_inch;
};
void main()
{
      vol room;
      char ch[10];
      cout << "\n Enter  length in feet and inches(XfeetXinch/X F. X I.) :";
      cin>>room.l_in_feet>>ch>>room.l_in_inch>>ch;
```

```
      cout << "\n Enter breadth  in feet and inches (XfeetXinch..):";
      cin >>room.b_in_feet >> ch >>room.b_in_inch >> ch;
      cout << "\n Enter  height in feet and inches(XfeetXinch…) :";
      cin >>room.h_in_feet >> ch >>room.h_in_inch >> ch;
      float len, br, height;
      len =room.l_in_feet + (float)(room.l_in_inch/12);
      br = room.b_in_feet + (float)(room.b_in_inch/12);
      height = room.h_in_feet + (float)(room.h_in_inch/12);
      double  volm = (double)len * br*height;
      cout<< "\n The Length  of the Room = " << len << "feet";
      cout<< "\n The Breadth of the Room = "<< br << "feet";
      cout<< "\n The Volume of the Room =" << height << "feet";
      cout<< "\n The Volume of the Room =" << volm << "c.feet";
      getch();
}
```

6. **Write a program to prepare the invoice from the following data :**
customer number
customer name and address
date of sale, description
quantity
unit price
discount percentage
sales tax percentage

Ans.

```
#include<iostream.h>
#include<conio.h>
#include<stdio.h>
struct date
{
      int day;
      int mon;
      int yr;
};
struct invo
{
      int cust_num;
      char cust_nm[20];
      char add[40];
      date D_O_sale;
      char descp[30];
      int quan;
      int unit_pr;
      float discount;
      float sales_tax;
};
void main()
{
      invo Customer[10];
      char c;
      for(int i = 0; i< 10; i++)
      {
            cout<< "\n Enter the customer no.";
            cin>> Customer[i].cust_num;
            cout<< "\n Enter the Customer name :";
            gets( Customer[i].cust_nm);
            cout<< "Enter Date of Sale (dd-mm-yy):";
            cin >>
```

```
Customer[i].D_O_sale.day>>c>>Customer[i].D_O_sale.mon>>c>>Customer[i].D_O_sale.
yr;
            cout<< "\n Enter Description :";
            gets( Customer[i].descp);
            cout<< "\nEnter Quantity : ";
            cin>> Customer[i].quan;
            cout<< "\n Unit Price ?";
            cin >> Customer[i].unit_pr;
            cout<<"\n Discount :";
            cin >> Customer[i].discount;
            cout<<"\n Sales Tax :";
            cin>> Customer[i].sales_tax;
      }
      clrscr();
      cout<<" \n Customer Num.     Customer Name \t Address \t Date-of-Sale
Desc \t Quantity    Unit Price   Discount%   Sales-Tax% \n\n";
      cout<<"============================================================== ";
      for( i = 0; i< 10; i++)
      {
            cout<< Customer[i].cust_num << "   "  << Customer[i].cust_nm << "\t"
<< Customer[i].add << "\t" << Customer[i].D_O_sale.day<<"-"<<
Customer[i].D_O_sale.mon << "-" << Customer[i].D_O_sale.yr << "    "<<
Customer[i].descp << "\t" <<  Customer[i].quan << "   "<<   Customer[i].unit_pr
<< "    "<<  Customer[i].discount << "    "  << Customer[i].sales_tax << endl ;
      }
      getch( );
}
```

7. **Details of 50 clients of an investment company are stored in an array of structures. Details include customer name, code, date of starting, number of years, interest rate, and total amount. Write a program to calculate compound interest for these clients.**

Ans.

```
#include<math.h>
#include<stdio.h>
#include<conio.h>
#include<iostream.h>
struct client_info
{
      char name[50];
      int code;
      double d_o_s;
      double year;
      double rate;
      double amount;
};
client_info client[50];
void main()
{
      int i,j;
      double compound,x;
      for(i=0;i<50;i++)
      {
            cout<<"enter customer name = ";
            gets(client[i].name);
            cout<<"enter code = ";
            cin>>client[i].code;
            cout<<"enter date of starting = ";
            cin>>client[i].d_o_s;
            cout<<"enter number of years = ";
```

```
            cin>>client[i].year;
            cout<<"enter intrest rate = ";
            cin>>client[i].rate;
            cout<<"enter total amount =";
            cin>>client[i].amount;
            x= client[i].amount*pow(( 1.0+client[i].rate/100.0),
client[i].year);
            compound=x-client[i].amount;
      }
      for(i=0;i<50;i++)
      {
            cout<<" customer name = "<<client[i].name<<endl;
            cout<<"code = "<<client[i].code<<endl;
            cout<<"date of starting = "<<client[i].d_o_s<<endl;
            cout<<"number of years = "<<client[i].year<<endl;
            cout<<"intrest rate = "<<client[i].rate<<endl;
            cout<<"total amount ="<<client[i].amount<<endl;
            cout<<"compound intrest ="<<compound<<endl;
      }
      getch();
}
```

8. **An array stores details of 25 students (roll no, name, marks in three subjects). Write a program to create such an array and print out a list of students who have failed in more than one subjects. Assume 40% as pass marks.**

Ans.

```
#include<iostream.h>
#include<conio.h>
#include<stdio.h>
struct stud
{
      int roll;
      char nm[50];
      float m1, m2, m3;
};
typedef stud S;
void main()
{
      S student[25];
      for(int i =0 ; i < 25 ; i++)

{
            cout << "\n Enter Roll no :  ";
            cin >> student[i].roll;
            cout << "\n Enter Name : ";
                        gets(student[i].nm);
            cout << "\n Enter marks of three subjects :";
            cin >> student[i].m1 >> student[i].m2 >> student[i].m3 ;
      }
      cout<< "\n STUDENTS FAILED IN MORE THAN 1 SUBJECT \n ";
      for(i =0 ; i < 25 ; i++)
      {
            if(( student[i].m1< 40 && student[i].m2 < 40) || (student[i].m2 < 40
&& student[i].m3 < 40) || ( student[i].m1 < 40 && student[i].m3 < 40))
            cout << student[i].roll  << "\t" << student[i].nm << "\n";
      }
      getch();
}
```

9. **Write a program, which will read in student records and print them in sorted order. Each record should be**

represented by a C structure having member/fields for the first name, last name and student number (an integer). You should sort first by first name, then by last name (this way they will be fully sorted by name when you finish). You can read the information in from the console or from a file, and should print out the sorted list to the console. You can assume some reasonable upper limit on number of records (say, 25) if you want to use an array.

Ans.

```
#include <iostream.h>
#include <conio.h>
#include <stdio.h>
#include <string.h>
struct student
{
        char fname[20];
        char lname[20];
        int id_no;
};
typedef student S;
void main()
{
        S s[5];
        char tfname[20], tlname[20];
        int t;
        clrscr();
        for(int i = 0; i<5; i++)
        {
                cout<<"\n Enter Student's first name:";
                cin>>s[i].fname;
                cout<<"\n Enter Student's last name:";
                cin>>s[i].lname;
                cout<<"\n Enter ID NO";
                cin>>s[i].id_no;
        }
        for(i = 0; i<24; i++)
        {
                for(int j = i+1; j<5; j++)
                {
                        if(strcmp(s[i].fname, s[j].fname)>0)
                        {
                                strcpy(tfname, s[i].fname);
                                strcpy(s[i].fname, s[j].fname);
                                strcpy(s[j].fname, tfname);
                                strcpy(tlname,s[i].lname);
                                strcpy(s[i].lname,s[j].lname);
                                strcpy(s[j].lname,tlname);
                                t = s[i].id_no;
                                s[i].id_no = s[j].id_no;
                                s[j].id_no = t;
                        }
                        else
                        {
                                if(strcmp(s[i].fname, s[j].fname)==0)
                                {
                                        if(strcmp(s[i].lname, s[j].lname)>0)
                                        {
                                                strcpy(tfname,s[i].fname);
```

```
                                                strcpy(s[i].fname,s[j].fname);
                                                strcpy(s[j].fname,tfname);
                                                strcpy(tlname,s[i].lname);
                                                strcpy(s[i].lname,s[j].lname);
                                                strcpy(s[j].lname,tlname);
                                                t=s[i].id_no;
                                                s[i].id_no=s[j].id_no;
                                                s[j].id_no=t;
                                                }
                                        }
                                }
                        }

        }
cout<<"\n\n FIRST NAME \t LASTNAME \t ID NO ";
                        for(int k = 0; k<5; k++)
                        {
                                cout<<"\n"<< s[k].fname<<"\t" << s[k].lname;
                        }
getch();
}
```

10. **A linear array if size 50 stores following information's: name of the country, country's capital and per capita income of the country. Write a complete program in C++ to do the following :**
(a) To read a country's name and display capital and per-ca pita income.
(b) To read name of the capital city and displays country's name and displays country's name and per capital income.
Display an error message in case of an incorrect input.

Ans.

```
#include<iostream.h>
#include<conio.h>
#include <string.h>
#include <stdio.h>
#include <process.h>
struct country
{
char country[30];
char capital[30];
float income;
};

void main()
{
 country c[3];
 clrscr();
 for( int i=0; i<3 ; i++)
 {
  cout << "\n Country's name : ";
  cin.ignore();
  cin.getline(c[i].country, 30);

  cout << "\n Country's capital :";
  cin.getline(c[i].capital,30);

  cout << "\n Per capita income :";
```

```
    cin >> c[i].income;

  }

char ch = 'y';
char cap[30];
int flag = 0;
cin.ignore();
cout << "\n Enter Capital name : ";
cin.getline(cap, 30);

  for(int k=0; k<3 ; k++)
  {
    flag = 0;
    if(strcmp(c[k].capital,cap)==0)
    {
      flag = 1;
    }
    if(flag==1)
    {
      cout<< "\n" << c[k].country << "\t" << c[k].capital << "\t" << c[k].income << "\n\n" ;
    }
  }


char con[30];
cout << "\n Enter Country name : ";
cin.getline(con,30);
  for(int m=0; m<3 ; m++)
  {
    flag = 0;
    if(strcmp(c[m].country,con)==0)
    {
      flag = 1;
    }
    if(flag==1)
    {
      cout  << c[m].capital << "\t" << c[m].income << "\n" ;
    }
  }
getch();
}
```