Programming Projects

1. Ans:

```c
#include <stdio.h>

void divisibility(int);

void main()
{
        int n;
        printf("Enter any integer number -> ");
        scanf("%d", &n);

        divisibility(n);
}

void divisibility(int n)
{
        int sum = 0,r,num=n;
        printf("The digits of number %d from right to left is as below :-\n",num);
        while(n != 0)
        {
                r = n % 10;
                n = n /10;
                printf("%d ",r);
                sum += r;
        }

        if((sum % 9) == 0)
                printf("\nThe number %d is divisible by 9.\n",num);
        else
                printf("\nThe number %d is not divisible by 9.\n",num);
}
```

O/P

Enter any integer number -> 154368
The digits of number 154368 from right to left is as below :-
8 6 3 4 5 1
The number 154368 is divisible by 9.

Enter any integer number -> 621594
The digits of number 621594 from right to left is as below :-
4 9 5 1 2 6
The number 621594 is divisible by 9.

Enter any integer number -> 123456
The digits of number 123456 from right to left is as below :-
6 5 4 3 2 1
The number 123456 is not divisible by 9.

2. Ans:

```c
#include <stdio.h>
#include <math.h>
void main()
{
```

```c
    int n, i;
    double principal, annual_interest_rate, monthly_interest_rate, monthly_payment, balance,
principal_monthly, each_interest;
    printf("Enter the amount borrowed (principal) -> ");
    scanf("%lf", &principal);
    printf("\nEnter the annual interest rate -> ");
    scanf("%lf", &annual_interest_rate);
    printf("\nEnter the number of payments (in months) -> ");
    scanf("%d", &n);

    monthly_interest_rate = annual_interest_rate / 1200;
    monthly_payment = principal * monthly_interest_rate / (1 - 1 / pow(1 + monthly_interest_rate,
n));

    printf("\nMonthly Payment - $%.2f\n", monthly_payment);

    balance = principal;

    printf("\nPayment %8c Interest %8c Principal %9c Principal Balance", ' ', ' ', ' ');

    for(i = 0; i < n; i++)
    {
        each_interest = monthly_interest_rate * balance;
        principal_monthly = monthly_payment - each_interest;
        balance = balance - principal_monthly;

        printf("\n %d %13c %.2f %13c %.2f %13c %.2f", (i + 1), ' ', each_interest, ' ',
principal_monthly, ' ', balance);
    }
    printf("\nFinal Payment -  $%.2f\n", monthly_payment);
}
```

O/P

Enter the amount borrowed (principal) -> 1000.00

Enter the annual interest rate -> 9.0

Enter the number of payments (in months) -> 6

Monthly Payment - $171.07

Payment	Interest	Principal	Principal Balance
1	7.50	163.57	836.43
2	6.27	164.80	671.64
3	5.04	166.03	505.60
4	3.79	167.28	338.33
5	2.54	168.53	169.80
6	1.27	169.80	0.00

Final Payment - $171.07

3. (a) Ans:

```c
#include <stdio.h>

void main()
{
    int n, i, largest, smallest, t;
    double average, sum = 0;
```

```c
		printf("Enter the number of inputs -> ");
		scanf("%d", &n);
		printf("Enter the numbers ->\n");
		for(i = 0; i < n; i++)
		{
			if(i > 0)
			{
				scanf("%d", &t);
				if(t > largest)
					largest = t;
				if(t < smallest)
					smallest = t;
				sum += t;
			}
			else
			{
				scanf("%d", &t);
				largest = t;
				smallest = t;
				sum += t;
			}
		}
		average = sum / n;
		printf("\nLargest -> %d", largest);
		printf("\nSmallest -> %d", smallest);
		printf("\nAverage -> %.2f\n", average);
}
```

O/P

Enter the number of inputs -> 6
Enter the numbers ->
-5
3
-1
7
23
-11

Largest -> 23
Smallest -> -11
Average -> 2.67

3. (b) Ans:

```c
#include <stdio.h>
#include <math.h>

void main()
{
		int n, i, t;
		double average, standard_deviation, sum = 0, sum_squares = 0;
		printf("Enter the number of inputs -> ");
		scanf("%d", &n);
		printf("Enter the numbers ->\n");
		for(i = 0; i < n; i++)
		{
				scanf("%d", &t);
```

```
                sum += t;
                sum_squares += (t * t);
        }

        average = sum / n;
        standard_deviation = sqrt((sum_squares / n) - (average * average));
        printf("\nStandard Deviation -> %f\n", standard_deviation);
}
```

O/P

Enter the number of inputs -> 3
Enter the numbers ->
1
2
3

Standard Deviation -> 0.816497

4. Ans:

```
#include <stdio.h>
#include <math.h>

void main()
{
        int a, b, r, g, t, num1, num2;
        printf("GCD Calculator.");
        printf("\nEnter the first integer number -> ");
        scanf("%d", &num1);
        printf("\nEnter the second integer number -> ");
        scanf("%d", &num2);
        a=abs(num1);
        b=abs(num2);
        if((a % b) == 0)
                g = b;
        else
        {
                r = a % b;
                while(r != 0)
                {
                        a = b;
                        b = r;
                        r = a % b;
                }
                g = b;
        }
        printf("\nGCD of %d and %d is %d\n", num1,num2,g);
}
```

O/P

GCD Calculator.
Enter the first integer number -> -252

Enter the second integer number -> 735

GCD of -252 and 735 is 21

5. Ans:

```c
#include <stdio.h>
#define SUBS 0.08

void print_chart(int, double, double, double, double);
void main()
{
            double efficiency, gasoline, distance, subs;
            int passengers, input_status;

            printf("%5cCARPOOLS MEETING MINIMUM PASSENGER EFFICIENCY OF 25 PASSENGER KM/L", ' ');

            printf("\nPassengers %3c Weekly Commute (km) %3c Gasoline Consumption(L) %3c Efficiency (pass km/L) %3c Weekly Subsidy($)", ' ', ' ', ' ', ' ');

            while((input_status = scanf("%d%lf%lf", &passengers, &distance, &gasoline)) != EOF)
            {
                        if(passengers == 0)
                                    break;
                        efficiency = (passengers * distance) / gasoline;
                        subs = passengers * distance * SUBS;
                        print_chart(passengers, efficiency, gasoline, distance, subs);
            }

}

void print_chart(int passengers, double efficiency, double gasoline, double distance, double subs)
{
            printf("\n%d %15c %.2f %18c %.2f %20c %.2f %20c %.2f", passengers, ' ', distance, ' ', gasoline, ' ', efficiency, ' ', subs);
}
```

O/P

Passengers	Weekly Commute (km)	Gasoline Consumption(L)	Efficiency (pass km/L)	Weekly Subsidy($)
4	75.00	11.00	27.27	24.00
2	60.00	4.50	26.67	9.60

CARPOOLS MEETING MINIMUM PASSENGER EFFICIENCY OF 25 PASSENGER KM/L

6. Ans:

```c
#include <stdio.h>
# define SENTINAL -99

void main()
{
   int n, i, hot_days = 0, cold_days = 0, pleasant_days = 0, temp;
   double avg_temp, temp_sum;

   printf("Enter the first temperature value (or %d to quit) -> ",SENTINAL);
            scanf("%d", &temp);

   while(temp != SENTINAL)
   {
     temp_sum += temp;
     if(temp >= 85)
     {
        printf("\n%d is a Hot Day\n", temp);
```

```c
          hot_days++;
        }
      else if(temp >= 60)
      {
        printf("\n%d is a Pleasant Day\n", temp);
        pleasant_days++;
      }
      else
      {
        printf("\n%d is a Cold Day\n", temp);
        cold_days++;
      }
   printf("\nEnter the next temperature value (or %d to quit) -> ",SENTINAL);
            scanf("%d", &temp);
   }

   avg_temp = temp_sum / (hot_days + cold_days + pleasant_days);

   printf("\nNumber of Hot Days -> %d", hot_days);
   printf("\nNumber of Pleasant Days -> %d", cold_days);
   printf("\nNumber of Cold Days -> %d\n", pleasant_days);
   printf("\nAverage Temperature is -> %.2f\n", avg_temp);
}
```

O/P

Enter the first temperature value (or -99 to quit) -> 55

55 is a Cold Day

Enter the next temperature value (or -99 to quit) -> 60

60 is a Pleasant Day

Enter the next temperature value (or -99 to quit) -> 85

85 is a Hot Day

Enter the next temperature value (or -99 to quit) -> -99

Number of Hot Days -> 1
Number of Pleasant Days -> 1
Number of Cold Days -> 1

Average Temperature is -> 66.67

7. Ans:

```c
#include <stdio.h>
#define TAX 3.625
void main()
{
   int i, id_number, employees;
   double wage_rate, overtime_wage, hours_worked, overtime, grosspay, netpay, overtimepay,
total_payroll = 0, avg;
   printf("\nEnter the number of employees -> ");
   scanf("%d", &employees);

   for(i = 0; i < employees; i++)
```

```c
  {
     printf("\nEnter ID number of employee %d-> ",(i+1));
     scanf("%d", &id_number);
     printf("\nEnter hourly wage rate -> ");
     scanf("%lf", &wage_rate);
     printf("\nEnter hours worked -> ");
     scanf("%lf", &hours_worked);

     if (hours_worked < 0)
     printf("Invalid Input.");
     else if (hours_worked <= 40)
                    {
                                 grosspay = hours_worked * wage_rate;
                    }
                    else
                    {
                                 overtime_wage = 1.5 * wage_rate;
                                 overtimepay = (hours_worked - 40) * overtime_wage;
                                 grosspay = (40 * wage_rate) + overtimepay;
                    }
                                 netpay = grosspay - (grosspay * (TAX / 100));
                                 total_payroll += netpay;
                                 printf("\nEmployee ID -> %d", id_number);
                                 printf("\nNet pay -> %.2f", netpay);
  }

  avg = total_payroll / employees;
  printf("\n\nTotal payroll -> %.2f", total_payroll);
  printf("\nAverage amount paid -> %.2f\n", avg);
}
```

O/P

Enter the number of employees -> 3

Enter ID number of employee 1-> 111

Enter hourly wage rate -> 500

Enter hours worked -> 20

Employee ID -> 111
Net pay -> 9637.50

Enter ID number of employee 2-> 112

Enter hourly wage rate -> 400

Enter hours worked -> 65

Employee ID -> 112
Net pay -> 29876.25

Enter ID number of employee 3-> 113

Enter hourly wage rate -> 1000

Enter hours worked -> 15

Employee ID -> 113
Net pay -> 14456.25

Total payroll -> 53970.00
Average amount paid -> 17990.00

8. Ans:

```c
#include <stdio.h>

void main()
{
    int i = 1, brand1=0, brand2=0, brand3=0, brand4=0, brand_id, amount, final_inventory = 0, temp, quantity, option;
    printf("Please Enter the case inventory of each brand for the start of the week. ");
    while(i <= 4)
    {
        printf("\nEnter the number of beers of ID Number %d-> ",i);
        scanf("%d", &quantity);
        if(i==1){
            brand1 += quantity;
            i++;

        }
        else if(i==2){
            brand2 += quantity;
            i++;

        }
        else if(i==3){
            brand3 += quantity;
            i++;

        }
        else{
            brand4 += quantity;
            i++;

        }
    }
    printf("\nDo you want to enter any sales and purchase records?(Press 1 for yes/ 0 for no)->");
    scanf("%d", &option);
    while(option == 1)
    {
        printf("\nEnter Brand ID Number -> ");
        scanf("%d", &brand_id);
        if(brand_id==1){
            printf("\nEnter the number of items purchased of Brand ID %d -> ",brand_id);
            scanf("%d", &amount);
            brand1 += amount;
            printf("\nEnter the number of items sold of Brand ID %d -> ",brand_id);
            scanf("%d", &amount);
            brand1 -= amount;
        }
        else if(brand_id==2){
            printf("\nEnter the number of items purchased of Brand ID %d -> ",brand_id);
            scanf("%d", &amount);
            brand2 += amount;
```

```c
                                                printf("\nEnter the number of items sold of Brand ID %d -> ",brand_id);

                                                scanf("%d", &amount);
                                                brand2 -= amount;
                                    }
                                    else if(brand_id==3){
                                                printf("\nEnter the number of items purchased of Brand ID %d -> ",brand_id);

                                                scanf("%d", &amount);
                                                brand3 += amount;
                                                printf("\nEnter the number of items sold of Brand ID %d -> ",brand_id);

                                                scanf("%d", &amount);
                                                brand3 -= amount;
                                    }
                                    else if(brand_id==4){
                                                printf("\nEnter the number of items purchased of Brand ID %d -> ",brand_id);

                                                scanf("%d", &amount);
                                                brand4 += amount;
                                                printf("\nEnter the number of items sold of Brand ID %d -> ",brand_id);

                                                scanf("%d", &amount);
                                                brand4 -= amount;
                                    }
                        else
                           printf("\nInvalid brand ID.");

                                    printf("\nDo you want to enter any more sales and purchase records?(Press 1 for yes/ 0 for no)->");
                                    scanf("%d", &option);
                        }
            printf("\nNumber of beers in Brand ID Number 1 -> %d", brand1);
            printf("\nNumber of beers in Brand ID Number 2 -> %d", brand2);
            printf("\nNumber of beers in Brand ID Number 3 -> %d", brand3);
            printf("\nNumber of beers in Brand ID Number 4 -> %d", brand4);
}
```

O/P

Please Enter the case inventory of each brand for the start of the week.
Enter the number of beers of ID Number 1-> 10

Enter the number of beers of ID Number 2-> 30

Enter the number of beers of ID Number 3-> 20

Enter the number of beers of ID Number 4-> 40

Do you want to enter any sales and purchase records?(Press 1 for yes/ 0 for no)->1

Enter Brand ID Number -> 4

Enter the number of items purchased of Brand ID 4 -> 0

Enter the number of items sold of Brand ID 4 -> 25

Do you want to enter any more sales and purchase records?(Press 1 for yes/ 0 for no)->1

Enter Brand ID Number -> 2

Enter the number of items purchased of Brand ID 2 -> 5

Enter the number of items sold of Brand ID 2 -> 10

Do you want to enter any more sales and purchase records?(Press 1 for yes/ 0 for no)->0

Number of beers in Brand ID Number 1 -> 10
Number of beers in Brand ID Number 2 -> 25
Number of beers in Brand ID Number 3 -> 20
Number of beers in Brand ID Number 4 -> 15

9. Ans:

```c
#include <stdio.h>
#define a 3.592
#define b 0.0427
#define R 0.08206
void print_table(double, double);
void main()
{
        double volume_initial, volume_final, volume_increment, kelvin_temp, moles, pressure;

        printf("Please enter at the prompts the number of moles of carbon dioxide, the absolute
temperature, the initial volume in milliliters, the final volume, and the increment volume between lines of
the table.\n");

        printf("\nQuantity of carbon dioxide (moles)> ");
        scanf("%lf", &moles);
        printf("\nTemperature (kelvin)> ");
        scanf("%lf", &kelvin_temp);
        printf("\nInitial volume (milliliters)> ");
        scanf("%lf", &volume_initial);
        printf("\nFinal volume (milliliters)> ");
        scanf("%lf", &volume_final);
        printf("\nVolume increment (milliliters)> ");
        scanf("%lf", &volume_increment);

        printf("\n%.4f moles of carbon dioxide at %.2f kelvin\n",moles,kelvin_temp);
        printf("\nVolume (ml) %5c Pressure (atm)",' ');

        while(volume_initial <= volume_final)
        {
                pressure = ((moles * R * kelvin_temp) / (volume_initial/1000.0 - (b * moles))) - ((a *
moles * moles) / (volume_initial/1000.0 * volume_initial/1000.0));

                print_table(volume_initial, pressure);

                volume_initial += volume_increment;
        }
        printf("\n");
}

void print_table(double volume, double pressure)
{
        printf("\n %.2f %10c %.4f", volume, ' ', pressure);
}
```

Please enter at the prompts the number of moles of carbon dioxide, the absolute temperature, the initial volume in milliliters, the final volume, and the increment volume between lines of the table.

Quantity of carbon dioxide (moles)> 0.02

Temperature (kelvin)> 300

Initial volume (milliliters)> 400

Final volume (milliliters)> 600

Volume increment (milliliters)> 50

0.0200 moles of carbon dioxide at 300.00 kelvin
Volume (ml)   Pressure (atm)
400.00   1.2246
450.00   1.0891
500.00   0.9807
550.00   0.8918
600.00   0.8178

10. Ans:

```c
#include <stdio.h>
#include <math.h>
#define R_COEFF 0.014
#define SLOPE 0.0015
#define FLOW 1000
#define WIDTH 15
double cal_flow(double);
int within_desired(double);
void main()
{
        double depth, temp_flow, difference, error;
        int flag = -1, i = 0;

        printf("\nAt a depth of 5.0000 feet, the flow is 641.3255 cubic feet per second.");

        while(flag != 1)
        {
                if(i == 0)
                {
                        printf("\nEnter your initial guess for the channel depth when the flow is
%d cubic feet per second", FLOW);
                        printf("\nEnter guess>");
                }
                else
                        printf("\nEnter guess>");
                scanf("%lf", &depth);
                temp_flow = cal_flow(depth);

                difference = (double)FLOW - temp_flow;
                error = (difference / FLOW) * 100;

                printf("\nDepth: %.4f Flow: %.4f cfs Target: 1000 cfs Difference: %.4f Error: %.4f
percent", depth, temp_flow, difference, error);
```

```
                    flag = within_desired(temp_flow);
                    i = -1;
            }
}

double cal_flow(double depth)
{
            double area, hydraulic_radius, temp_flow;

            hydraulic_radius = (depth * WIDTH) / ((2 * depth) + WIDTH);
            area = depth * WIDTH;
            temp_flow = (1.486/R_COEFF) * (area * pow(cbrt(hydraulic_radius), 2)) * sqrt(SLOPE);

            return temp_flow;
}

int within_desired(double num)
{
            if(num >= ((FLOW - ((0.1/100) * FLOW))) && (num <= (FLOW + ((0.1/100) * FLOW))))
                    return 1;
            return 0;
}
```

O/P

At a depth of 5.0000 feet, the flow is 641.3255 cubic feet per second.
Enter your initial guess for the channel depth when the flow is 1000 cubic feet per second
Enter guess>6

Depth: 6.0000 Flow: 825.5906 cfs Target: 1000 cfs Difference: 174.4094 Error: 17.4409 percent
Enter guess>7

Depth: 7.0000 Flow: 1017.7784 cfs Target: 1000 cfs Difference: -17.7784 Error: -1.7778 percent
Enter guess>6.9

Depth: 6.9000 Flow: 998.2561 cfs Target: 1000 cfs Difference: 1.7439 Error: 0.1744 percent
Enter guess>6.91

Depth: 6.9100 Flow: 1000.2056 cfs Target: 1000 cfs Difference: -0.2056 Error: -0.0206 percent

11. Ans:

```
#include <stdio.h>

double fast_food_billion(int);
void main()
{
            int year;
            double charges;
            printf("\nEnter year (or any year before 2005 to stop)- ");
            scanf("%d", &year);
            while(year >= 2005)
            {
                    charges = fast_food_billion(year);
                    printf("\nCharges for %d - %.1f billions", year, charges);
                    printf("\nEnter year (or any year before 2005 to stop)- ");
                    scanf("%d", &year);
            }
            printf("\n");
```

```
}

double fast_food_billion(int year)
{
        double charges = 33.2 + (16.8 * (double)(year - 2005));
        return charges;
}
```

O/P

Enter year (or any year before 2005 to stop)- 2006

Charges for 2006 - 50.0 billions
Enter year (or any year before 2005 to stop)- 2005

Charges for 2005 - 33.2 billions
Enter year (or any year before 2005 to stop)- 2004

12. Ans:

```
#include <stdio.h>

void main()
{
        int player;
        char c = ' ';
        while(scanf("%d", &player) != EOF)
        {
                int hits = 0, bats = 0;

                printf("\n\nPlayer %d's record: ", player);

                scanf("%c", &c);
                if(c != '\n')
                {
                        if((c == 'O') || (c == 'H'))
                                bats++;

                        if(c == 'H')
                                hits++;

                        while(c != '\n')
                        {
                                if((c == 'O') || (c == 'H'))
                                        bats++;

                                scanf("%c", &c);

                                if(c == 'H')
                                        hits++;

                                printf("%c", c);
                        }
                }
                printf("Player %d's batting average: %.3f", player, ((double)hits / bats));
        }
        printf("\n");
}
```

Player 12's record: HOOOWSHHOOHPWWHO
Player 12's batting average: 0.455

Player 4's record: OSOHHHWWOHOHOOO
Player 4's batting average: 0.417

Player 7's record: WPOHOOHWOHHOWOO
Player 7's batting average: 0.364

13. Ans:

```c
#include <stdio.h>
#include <math.h>
#define HALF_LIFE 5.272
#define e 2.71828

void main()
{
        int i;
        double amount, r;
        printf("\nEnter the initial amount of Cobalt (in grams) - ");
        scanf("%lf", &amount);

        printf("\nYear %8c Amount Remains", ' ');
        for (i = 1; i <= 5; i++)
        {
                r = (amount * pow(pow(e,-0.693), (i / HALF_LIFE)));
                printf("\n %d %10c %.4f g", i, ' ', r);
        }
        printf("\n");
}
```

Enter the initial amount of Cobalt (in grams) - 50

Year	Amount Remains
1	43.8412 g
2	38.4410 g
3	33.7060 g
4	29.5542 g
5	25.9139 g

14. Ans:

```c
#include <stdio.h>
void main()
{
        int i;
        double PI = 0, t = -1;
        for(i = 1; i <= 99 ; i += 2)
        {
                t *= -1;
                PI = PI + 1/(t * i);
        }
        PI *= 4;
        printf("\nPI :- %f\n", PI);
}
```

PI :- 3.121595

15. Ans:

```c
#include <stdio.h>
#include <math.h>
#include <stdlib.h>

double next_approx(double, double, double);
double func(double, double, double);
double derivative(double, double);

void main()
{
   int flag = 0;
        double x0, n, c, x1, i, temp;
        printf("\nEnter c -> ");
        scanf("%lf", &c);
        printf("\nEnter n -> ");
        scanf("%lf", &n);

        x0 = c / 2;

        for(i = 0; i < 100; i++)
        {
                x1 = next_approx(x0, n, c);
                if(fabs(x1-x0)<0.0000001)
                {
                   flag=1;
                   break;
                }
                x0=x1;
        }
        if(flag == 1)
        printf("\nThe value of root is %.6f \n", x0);
        else
        printf("\nNewton's method failed to converge to a root.");
}

double next_approx(double temp, double n, double c)
{
        double next_approx = temp - (func(temp, n, c) / derivative(temp, n));
        return next_approx;
}

double func(double x, double n, double c)
{
        return ((pow(x, n)) - c);
}

double derivative(double x, double n)
{
        return (n * pow(x, n - 1));
}
```

Enter c -> 2

Enter n -> 2

The value of root is 1.414214

Enter c -> 500

Enter n -> 100

Newton's method failed to converge to a root.

16. Ans:

```c
#include <stdio.h>
#include <math.h>
void trap(double, double, int, double func(double));
double func1(double);
double func2(double);
void main()
{
        int n;

        printf("\n\nfor x^2sin(x)\n");
        for(n = 2; n <= 128; n *= 2)
        {
                printf("\nFor n = %d", n);
                trap(0, 3.14159, n, func2);
        }

        printf("\nfor sqrt(4 – x^2)\n");
        for(n = 2; n <= 128; n *= 2)
        {
                printf("\nFor n = %d", n);
                trap(-2, 2, n, func1);
        }
}

void trap(double a, double b, int n, double func(double))
{
        double h, T = 0, temp = a, f=0;
        int i;

        h = (b - a) / n;

        for(i = 1; i < n; i++)
        {
                temp += h;
                f += func(temp);
        }

        T = (h / 2) * (func(a) + func(b) + (2 * f));
        printf("\nT = %f\n", T);
}

// h(x) = sqrt(4 – x^2)
```

```
double func1(double x)
{
        return sqrt(4 - (x * x));
}

// g(x) = x^2 * sin(x)
double func2(double x)
{
        return (x * x * sin(x));
}
```

O/P

for x^2sin(x)

For n = 2
T = 3.875795

For n = 4
T = 5.363637

For n = 8
T = 5.742844

For n = 16
T = 5.837900

For n = 32
T = 5.861678

For n = 64
T = 5.867623

For n = 128
T = 5.869109

for sqrt(4 – x^2)

For n = 2
T = 4.000000

For n = 4
T = 5.464102

For n = 8
T = 5.991418

For n = 16
T = 6.179638

For n = 32
T = 6.246506

For n = 64
T = 6.270205

For n = 128
T = 6.278594