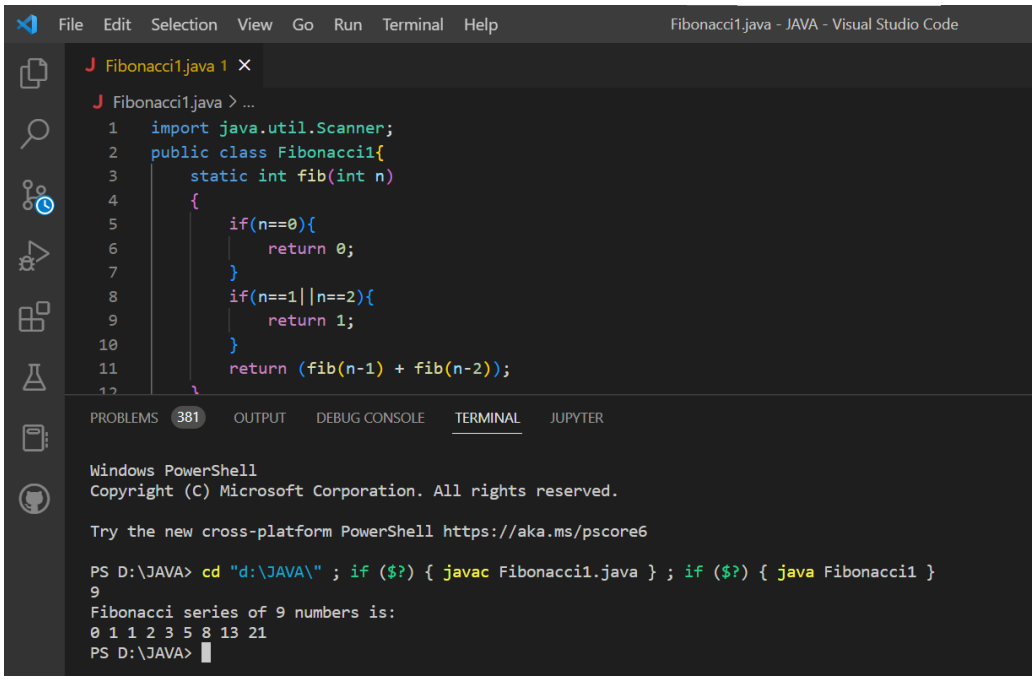
Assignment-1

Code:

i) With Recursion

```
import java.util.Scanner;
public class Fibonacci1{
   static int fib(int n)
   {
      if(n==0){
         return 0;
      }
      if(n==1||n==2){
         return 1;
      }
      return (fib(n-1) + fib(n-2));
   }
   public static void main(String args[])
   {
      Scanner input = new Scanner(System.in);
      int n = input.nextInt();
      System.out.println("Fibonacci series of "+n+" numbers is:");
      for(int i=0; i<n; i++){
         System.out.print(fib(i)+" ");
      }
   }
}
```

Output:



ii) Without Recursion

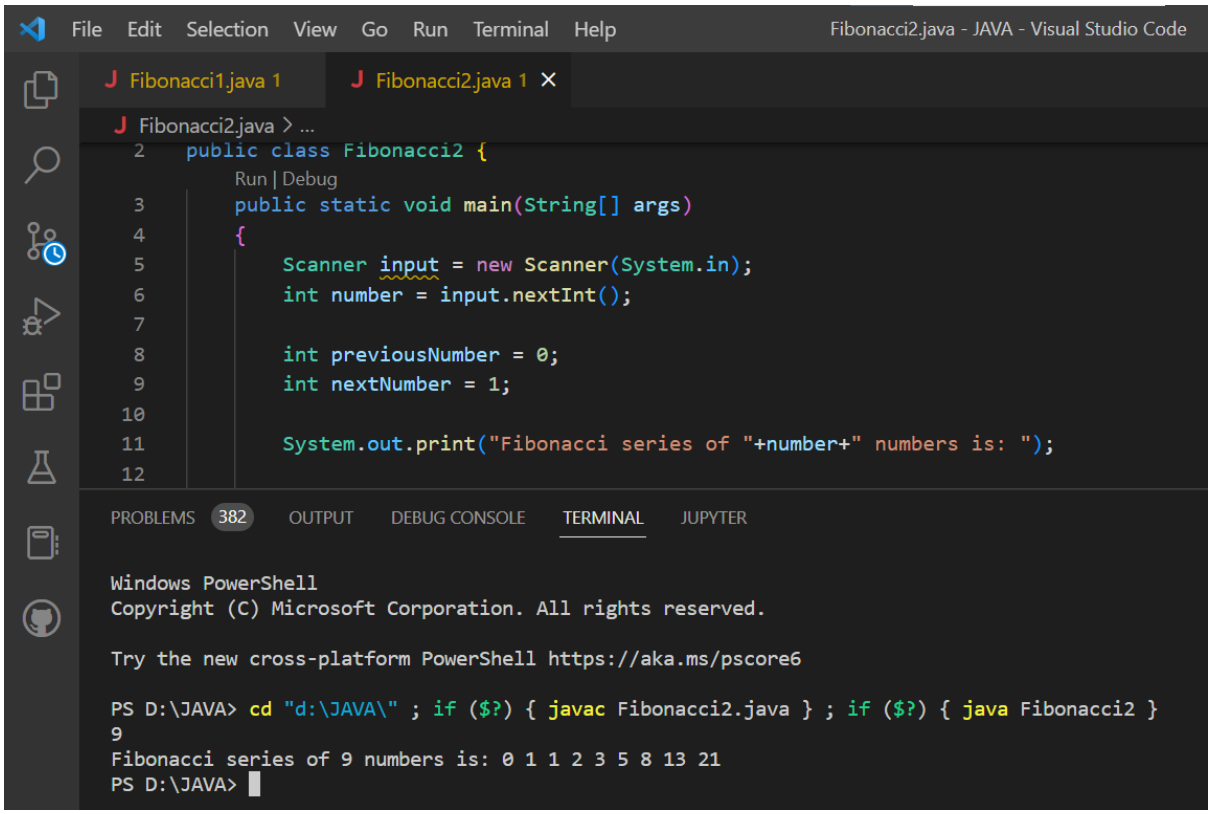
```
import java.util.Scanner;
public class Fibonacci2 {
   public static void main(String[] args)
     {
      Scanner input = new Scanner(System.in);
      int number = input.nextInt();

              int previousNumber = 0;
              int nextNumber = 1;

         System.out.print("Fibonacci series of "+number+" numbers is: ");

         for (int i = 1; i <= number; ++i){
            System.out.print(previousNumber+" ");
            int sum = previousNumber + nextNumber;
            previousNumber = nextNumber;
            nextNumber = sum;
         }
     }
}
```

Output:



Assignment-5

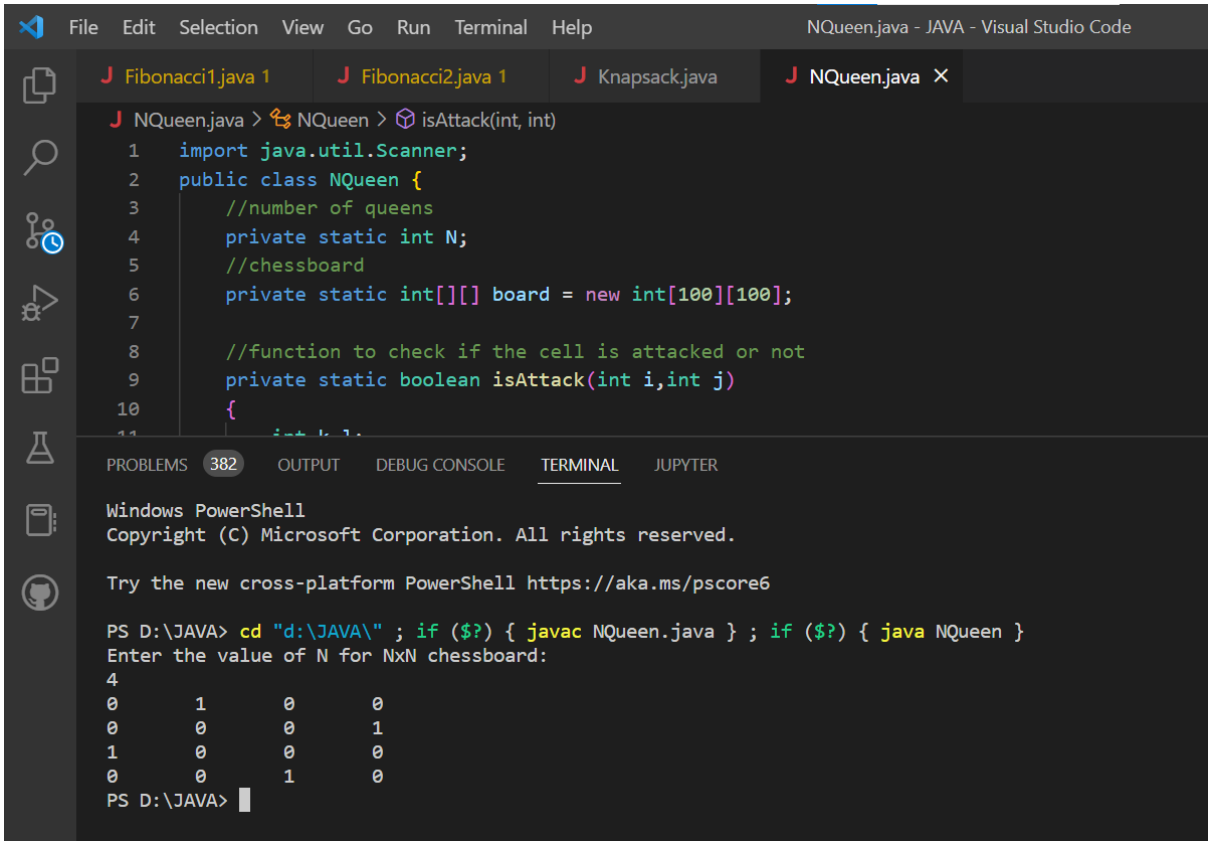
Code:

```
import java.util.Scanner;
public class NQueen {
   //number of queens
   private static int N;
   //chessboard
   private static int[][] board = new int[100][100];
   //function to check if the cell is attacked or not
   private static boolean isAttack(int i,int j)
   {
      int k,l;
      //checking if there is a queen in row or column
      for(k=0;k<N;k++)
      {
         if((board[i][k] == 1) || (board[k][j] == 1))
            return true;
      }
      //checking for diagonals
      for(k=0;k<N;k++)
      {
         for(l=0;l<N;l++)
         {
            if(((k+l) == (i+j)) || ((k-l) == (i-j)))
            {
               if(board[k][l] == 1)
                  return true;
            }
         }
      }
```

```
    return false;
}
private static boolean nQueen(int n)
{
    int i,j;
    //if n is 0, solution found
    if(n==0)
        return true;
    for(i=0;i<N;i++){
        for(j=0;j<N;j++){
            /* checking if we can place a queen here or not queen will not be placed
            if the place is being attacked or already occupied */
            if((!isAttack(i,j)) && (board[i][j]!=1)){
                board[i][j] = 1;
                if(nQueen(n-1)==true)
                {
                    return true;
                }
                board[i][j] = 0;
            }
        }
    }
    return false;
}
public static void main(String[] args){
    Scanner input = new Scanner(System.in);
    //taking the value of N
    System.out.println("Enter the value of N for NxN chessboard: ");
    N = input.nextInt();
    int i,j;
    //calling the function
```

```
        nQueen(N);
        //printing the matix
        for(i=0;i<N;i++)
        {
            for(j=0;j<N;j++)
                System.out.print(board[i][j]+"\t");
            System.out.print("\n");
        }
    }
}
```

Output:



Assignment-3

Code:

```
import java.util.Scanner;
class Knapsack
{
public static void main(String[] args)
{
Scanner sc=new Scanner(System.in);
int object,m;
System.out.println("Enter the Total Objects: ");
object=sc.nextInt();
int weight[]=new int[object];
int profit[]=new int[object];
for(int i=0;i<object;i++)
{
System.out.println("Enter the Profit: ");
profit[i]=sc.nextInt();
System.out.println("Enter the Weight: ");
weight[i]=sc.nextInt();
}
System.out.println("Enter the Knapsack capacity: ");
m=sc.nextInt();
double p_w[]=new double[object];
for(int i=0;i<object;i++)
{
p_w[i]=(double)profit[i]/(double)weight[i];
}
System.out.println("");
System.out.println("-----Dataset------");
System.out.println("");
```

```
System.out.print("Objects ");
for(int i=1;i<=object;i++)
{
System.out.print(i+"    ");
}
System.out.println();
System.out.print("Profit ");
for(int i=0;i<object;i++)
{
System.out.print(profit[i]+"    ");
}
System.out.println();
System.out.print("Weight ");
for(int i=0;i<object;i++)
{
System.out.print(weight[i]+"    ");
}
System.out.println();
System.out.print("P/W    ");
for(int i=0;i<object;i++)
{
System.out.print(p_w[i]+"  ");
}
for(int i=0;i<object-1;i++)
{
for(int j=i+1;j<object;j++)
{
if(p_w[i]<p_w[j])
{
double temp=p_w[j];
p_w[j]=p_w[i];
```

```
p_w[i]=temp;

int temp1=profit[j];
profit[j]=profit[i];
profit[i]=temp1;

int temp2=weight[j];
weight[j]=weight[i];
weight[i]=temp2;
}
}
}
System.out.println("");
System.out.println("\n--After Arranging--");
System.out.println("");
System.out.print("Objects ");
for(int i=1;i<=object;i++)
{
System.out.print(i+"    ");
}
System.out.println();
System.out.print("Profit ");
for(int i=0;i<object;i++)
{
System.out.print(profit[i]+"    ");
}
System.out.println();
System.out.print("Weight ");
for(int i=0;i<object;i++)
{
System.out.print(weight[i]+"    ");
```

```
}
System.out.println();
System.out.print("P/W    ");
for(int i=0;i<object;i++)
{
System.out.print(p_w[i]+"  ");
}
int k=0;
double sum=0;
System.out.println();
while(m>0)
{
if(weight[k]<m)
{
sum+=1*profit[k];
m=m-weight[k];
}
else
{
double x4=m*profit[k];
double x5=weight[k];
double x6=x4/x5;
sum=sum+x6;
m=0;
}
k++;
}
System.out.println("Final Profit = "+sum);
}
}
```

Output:

Output

Clear

```
java -cp /tmp/8GIB6PJTw2 Knapsack
Enter the Total Objects:
3
Enter the Profit:
60
Enter the Weight:
10
Enter the Profit:
100
Enter the Weight:
20
Enter the Profit:
120
Enter the Weight:
30
Enter the Knapsack capacity:
50
-----Dataset------
Objects 1    2    3
Profit 60    100    120    Weight 10    20    30
P/W    6.0  5.0  4.0

--After Arranging--

Objects 1    2    3
Profit 60    100    120
Weight 10    20    30
P/W    6.0  5.0  4.0
Final Profit = 240.0
```

Assignment-4

Code:

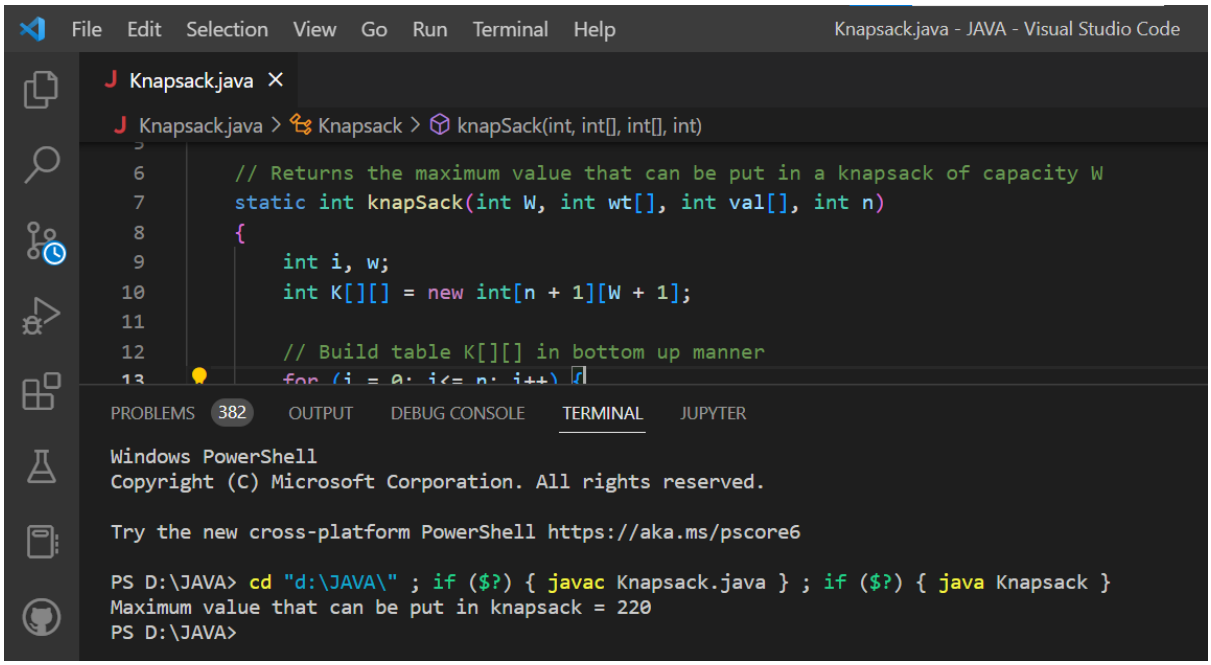
```
class Knapsack {
   static int max(int a, int b)
{ return (a > b) ? a : b; }

   // Returns the maximum value that can be put in a knapsack of capacity W
   static int knapSack(int W, int wt[], int val[], int n)
   {
      int i, w;
      int K[][] = new int[n + 1][W + 1];

      // Build table K[][] in bottom up manner
      for (i = 0; i<= n; i++) {
         for (w = 0; w<= W; w++) {
            if (i == 0 || w == 0)
               K[i][w] = 0;
            else if (wt[i - 1]<= w)
               K[i][w] = max(val[i - 1] + K[i - 1][w - wt[i - 1]], K[i - 1][w]);
            else
               K[i][w] = K[i - 1][w];
         }
      }
      return K[n][W];
   }
   public static void main(String args[])
   {
      int val[] = new int[] { 60, 100, 120 };
      int wt[] = new int[] { 10, 20, 30 };
      int W = 50;
```

```
        int n = val.length;
        System.out.println("Maximum value that can be put in knapsack = "+knapSack(W, wt, val, n));
    }
}
```

Output:



Assignment-2

Code:

```
class Node {
  private String data;
  private int frequency;
  private Node left;
  private Node right;
  public Node(String element, int freq){
    data = element;
    frequency = freq;
    left = null;
    right = null;
  }
  public void setRightChild(Node n)
  {
    right = n;
  }
  public void setLeftChild(Node n){
    left = n;
  }
  public Node getRightChild(){
    return right;
  }
  public Node getLeftChild(){
    return left;
  }
  public String getData(){
    return data;
  }
```

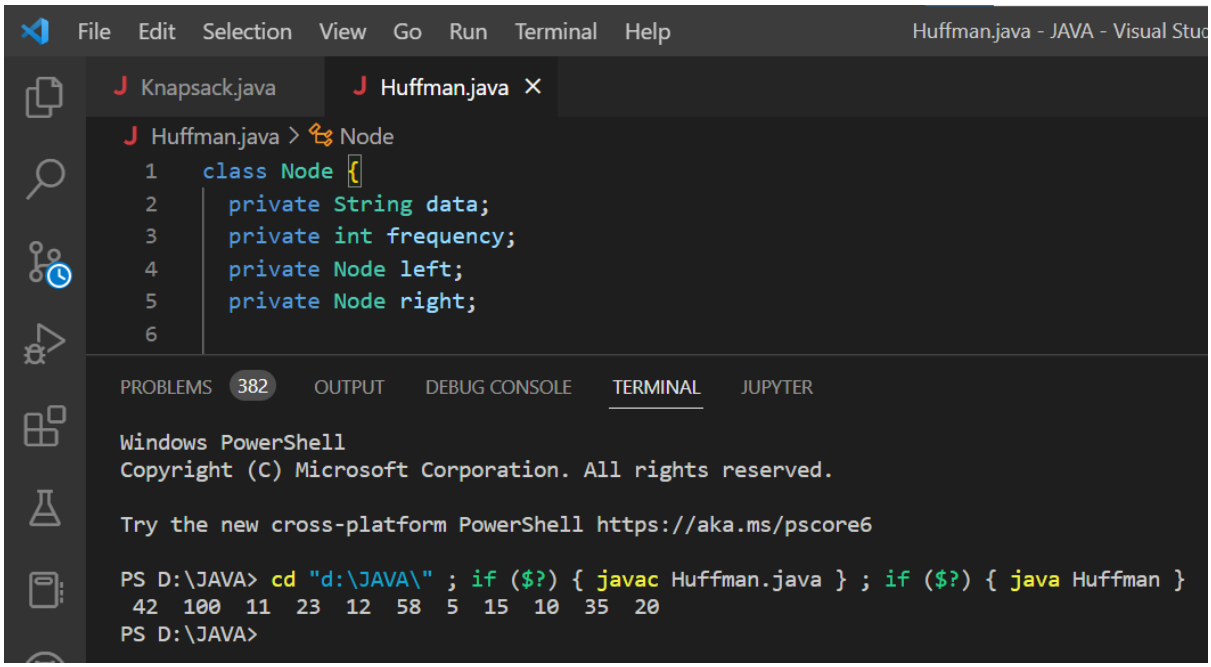
```
  public int getFrequency(){
    return frequency;
  }
  public static int getLeftChildIndex(int index) {
    if(((2*index) <= MinHeap.heapSize) && (index >= 1)) {
      return 2*index;
    }
    return -1;
  }
  public static int getRightChildIndex(int index) {
    if((((2*index)+1) <= MinHeap.heapSize) && (index >= 1)) {
      return (2*index)+1;
    }
    return -1;
  }
  public static int getParentIndex(int index){
    if((index > 1 && (index <= MinHeap.heapSize))) {
      return index/2;
    }
    return -1;
  }
  public static void inorder(Node root) {
    if(root != null) {
      inorder(root.getLeftChild());
      System.out.print(" "+root.getFrequency()+" ");
      inorder(root.getRightChild());
    }
  }
}
class MinHeap {
  public static int heapSize = 0;
```

```
  public static final int heapArraySize = 100;
  public static final int INF = 100000;
  public static void minHeapify(Node A[], int index) {
    int leftChildIndex = Node.getLeftChildIndex(index);
    int rightChildIndex = Node.getRightChildIndex(index);
    int smallest = index;
    if ((leftChildIndex <= MinHeap.heapSize) && (leftChildIndex>0)) {
      if (A[leftChildIndex].getFrequency() < A[smallest].getFrequency()) {
        smallest = leftChildIndex;
      }
    }
    if ((rightChildIndex <= MinHeap.heapSize) && (rightChildIndex>0)) {
      if (A[rightChildIndex].getFrequency() < A[smallest].getFrequency()) {
        smallest = rightChildIndex;
      }
    }
    // smallest is not the node, node is not a heap
    if (smallest != index) {
      Node temp;
      temp = A[index];
      A[index] = A[smallest];
      A[smallest] = temp;
      minHeapify(A, smallest);
    }
  }
}
class MinQueue {
  public static void insert(Node A[], Node a, int key) {
    MinHeap.heapSize++;
    A[MinHeap.heapSize] = a;
    int index = MinHeap.heapSize;
```

```
    while((index>1) && (A[Node.getParentIndex(index)].getFrequency() > a.getFrequency())) {
      Node temp;
      temp = A[index];
      A[index] = A[Node.getParentIndex(index)];
      A[Node.getParentIndex(index)] = temp;
      index = Node.getParentIndex(index);
    }
  }
  public static Node[] buildQueue(Node c[], int size) {
    Node[] a = new Node[MinHeap.heapArraySize];
    for(int i=0; i<size; i++) {
      MinQueue.insert(a, c[i], c[i].getFrequency());
    }
    return a;
  }
  public static Node extractMin(Node A[]) {
    Node minm = A[1];
    A[1] = A[MinHeap.heapSize];
    MinHeap.heapSize--;
    MinHeap.minHeapify(A, 1);
    return minm;
  }
}
class Huffman {
  public static Node greedyHuffmanCode(Node C[]) {
    Node[] minQueue = MinQueue.buildQueue(C, 6);
    while(MinHeap.heapSize > 1) {
      Node h = MinQueue.extractMin(minQueue);
      Node i = MinQueue.extractMin(minQueue);
      Node z = new Node("NONE", h.getFrequency()+i.getFrequency());
      z.setLeftChild(h);
```

```
    z.setRightChild(i);
    MinQueue.insert(minQueue, z, z.getFrequency());
  }
  return MinQueue.extractMin(minQueue);
 }
 public static void main(String[] args) {
  Node a = new Node("a", 42);
  Node b = new Node("b", 20);
  Node c = new Node("c", 5);
  Node d = new Node("d", 10);
  Node e = new Node("e", 11);
  Node f = new Node("f", 12);
  Node[] C = {a, b, c, d, e ,f};
  Node z = Huffman.greedyHuffmanCode(C);
  Node.inorder(z);
  System.out.println("");
 }
}
```

Output:



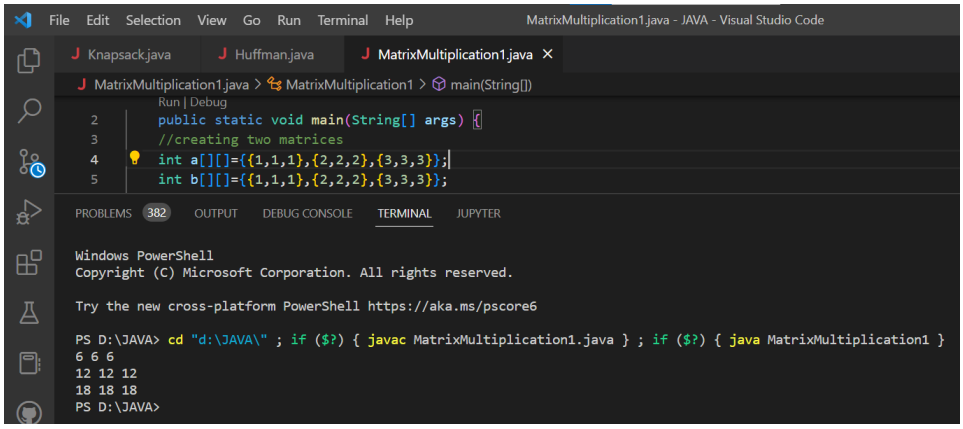
Mini Project

Matrix Multiplication

Code:

```
public class MatrixMultiplication1{
   public static void main(String[] args) {
   //creating two matrices
   int a[][]={{1,1,1},{2,2,2},{3,3,3}};
   int b[][]={{1,1,1},{2,2,2},{3,3,3}};
   int c[][]=new int[3][3];
   for(int i=0;i<3;i++){
   for(int j=0;j<3;j++){
   c[i][j]=0;
   for(int k=0;k<3;k++)
   {
   c[i][j]+=a[i][k]*b[k][j];
   }
   System.out.print(c[i][j]+" ");
   }
   System.out.println();
   }
   }
}
```

Output:



Multithreading Matrix Multiplication

Code:

```
import java.io.BufferedReader;
import java.io.InputStreamReader;
public class MatrixMultiplication2 extends Thread{
static int in1[][];
static int in2[][];
static int out[][];
static int n=2;
int row;
MatrixMultiplication2(int i)
{
row=i;
this.start();
}
public void run()
{
int i,j;
for(i=0;i<n;i++)
{
out[row][i]=0;
for(j=0;j<n;j++)
out[row][i]=out[row][i]+in1[row][j]*in2[j][i];
}
}
public static void main(String args[])
{
int i,j;
BufferedReader br=new BufferedReader(new InputStreamReader(System.in));
System.out.print("Enter the order of Matrix : ");
try
```

```
{
n=Integer.parseInt(br.readLine());
}catch(Exception e){}
in1=new int[n][n];
in2=new int[n][n];
out=new int[n][n];
System.out.println("Enter the First Matrix : ");
for(i=0;i<n;i++)
{
for(j=0;j<n;j++)
{
try
{
in1[i][j]=Integer.parseInt(br.readLine());
}catch(Exception e){}
}
}
System.out.println("Enter the Second Matrix : ");
for(i=0;i<n;i++)
{
for(j=0;j<n;j++)
{
try
{
in2[i][j]=Integer.parseInt(br.readLine());
}catch(Exception e){}
}
}
MatrixMultiplication2 mat[]=new MatrixMultiplication2[n];
for(i=0;i<n;i++)
mat[i]=new MatrixMultiplication2(i);
```

```
try
{
for(i=0;i<n;i++)
mat[i].join();
}catch(Exception e){}
System.out.println("Output :");
for(i=0;i<n;i++)
for(j=0;j<n;j++)
System.out.println(out[i][j]);
}
}
```

Output: