EXPERIMENT NO : 2

Name: Fale Manish Dinkar
Class: TE
Div: A
Roll No: T211036
Batch: A2

Problem Statement: Design suitable data structures and implement Pass-I and Pass-II of a two-pass macro-processor. The output of Pass-I (MNT, MDT and intermediate code file without any macro definitions) should be input for Pass-II.

PassI Macro Processor

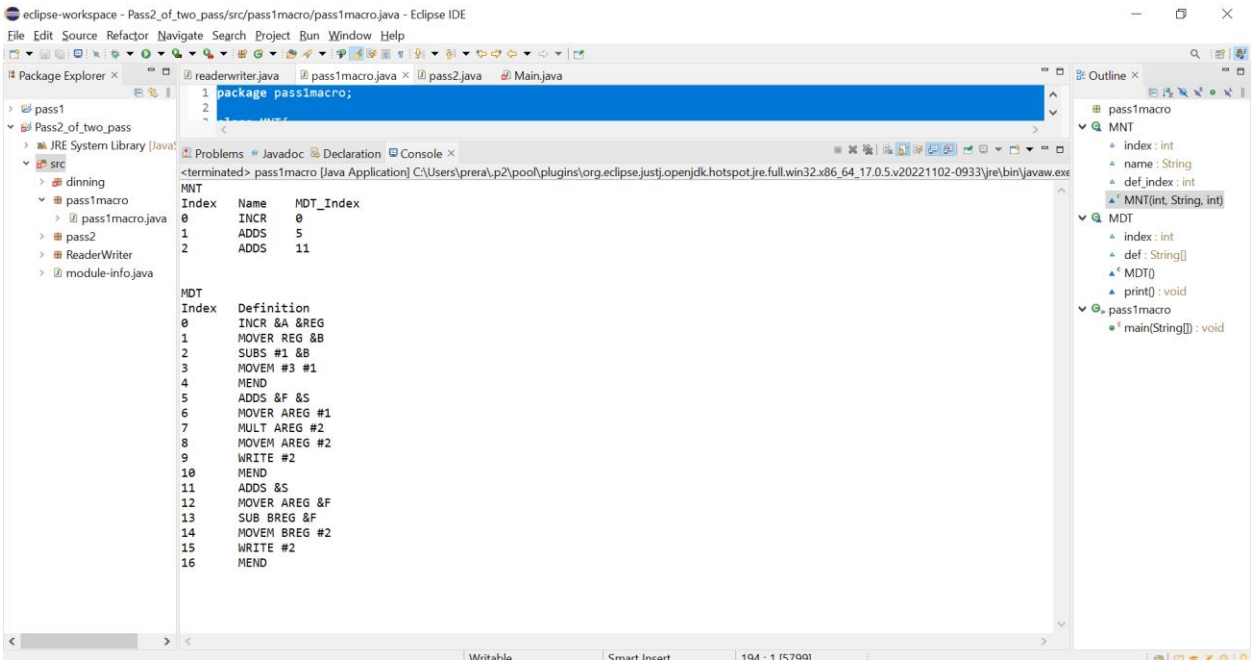
```
package pass1macro;
class MNT{
	int index;
	String name;
	int def_index;

	MNT(int i, String a, int j){
		index = i;
		name = a;
		def_index = j;
	}
}

class MDT{
	int index;
	String def[];

	MDT(){
		index = 0;
		def = new String[4];
	}

	void print(){
		if (def[0]!=null)
			System.out.print(def[0]+" ");
		if (def[1]!=null)
			System.out.print(def[1]+" ");
		if (def[2]!=null)
			System.out.print(def[2]+" ");
```

```
                    if (def[3]!=null)
                            System.out.print(def[3]+" ");

                    System.out.println();
                }

}

public class pass1macro{
   public static void main(String args[]){
        String input[][]={{"MACRO","INCR","&A",null,"&REG"},
                        {null,"MOVER","REG","&B",null},
                        {null, "SUBS","&A","&B",null},
                        {null, "MOVEM","&REG","&A",null},
                        {"MEND",null,null,null,null},
                        {"MACRO","ADDS","&F","&S",null},
                        {null,"MOVER","AREG","&F",null},
                        {null,"MULT","AREG","&S", null},
                        {null,"MOVEM","AREG","&S",null},
                        {null,"WRITE","&S",null,null},
                        {"MEND",null,null,null,null},
                        {"MACRO","ADDS",null,"&S",null},
                        {null, "MOVER","AREG","&F",null},
                        {null,"SUB","BREG","&F",null},
                        {null,"MOVEM","BREG","&S",null},
                        {null,"WRITE","&S",null,null},
                        {"MEND",null,null,null,null},
                        {null,"START",null,"200",null},
                        {null,"READ","N1",null,null},
                        {null, "READ","N2",null,null},
                        {null,"ADDS",null,"N2",null},
                        {null,"READ","N1","N2",null},
                        {null,"INCR","N1","N2", "DREG"},
                        {null,"STOP",null,null,null},
                        {"N1","DS","2",null,null},
                        {"N2","MULT","2",null,null},
                        {null,"END",null,null,null}};

   MNT n[] = new MNT[20];
   MDT d[]= new MDT[20];

   int i=0,nc=0,dc=0;

   String arr1,arr2,arr3,arr4,arr5;

   while(i<input.length){
      arr1= null;
      arr2= null;
      arr3= null;
      arr4= null;
      arr5= null;

      if(input[i][0] != null)
         arr1= input[i][0];
      if(arr1==null)
```

```
    arr1="null";
  if(arr1.equals("MACRO")){
    if(input[i][1]!=null)
       arr2=input[i][1];
    if(input[i][2]!=null)
       arr3=input[i][2];
    if(input[i][3]!=null)
       arr4=input[i][3];
    if(input[i][4]!=null)
       arr5=input[i][4];

    n[nc]=new MNT(nc,arr2,dc);
    nc++;

    while(!arr1.equals("MEND")){

       d[dc]= new MDT();
       d[dc].index = dc;

       d[dc].def[0]=arr2;
       if(!arr1.equals("MACRO")){
          if(arr3 != null) {
               if(arr3.equals(d[n[nc- 1].def_index].def[1]))
                        arr3 = "#1";
             else if(arr3.equals(d[n[nc- 1].def_index].def[2]))
                arr3 = "#2";
             else if(arr3.equals(d[n[nc- 1].def_index].def[3]))
                arr3 = "#3";
          }

                if(arr4!= null) {
                   if(arr4.equals(d[n[nc- 1].def_index].def[1]))
                      arr4="#1";
                   else if(arr4.equals(d[n[nc-1].def_index].def[2]))
                      arr4="#2";
                   else if(arr4.equals(d[n[nc- 1].def_index].def[3]))
                      arr4="#3";
                }
                if(arr5!= null){
                   if(arr5.equals(d[n[nc- 1].def_index].def[1]))
                      arr5="#1";
                   else if(arr5.equals(d[n[nc-11].def_index].def[2]))
                      arr5="#2";
                   else if(arr5.equals(d[n[nc-11].def_index].def[3]))
                      arr5="#3";
                        }
       }
       if(arr3!=null)
          d[dc].def[1]=arr3;
       if(arr4!=null)
          d[dc].def[2]=arr4;
       if(arr5!=null)
          d[dc].def[3]=arr5;

       dc++;
```

```
            i++;

            arr1 = arr2 = arr3 = arr4 = arr5 = null;

            if(input[i][0]!= null)
               arr1= input[i][0];
            if(input[i][1]!= null)
               arr2 = input[i][1];
            if(input[i][2] != null)
               arr3 = input[i][2];
            if(input[i][3] != null)
               arr4= input[i][3];
            if(input[i][4] != null)
               arr5= input[i][4];

            if(arr1== null)
               arr1="null";
         }

         if(arr1.equals("MEND")){
            d[dc]= new MDT();
            d[dc].index = dc;
            d[dc].def[0] = arr1;
            dc++;

         }
      }

      i++;
   }
      System.out.print("MNT\nIndex\tName\tMDT_Index\n");
         for(i=0;i<nc;i++){
      System.out.println(n[i].index+"\t"+n[i].name+"\t"+n[i].def_index);

      }

      System.out.print("\n\nMDT\nIndex\tDefinition\n");
      for(i=0;i<dc;i++){
         System.out.print(d[i].index+"\t");
         d[i].print();

      }
   }
}
```

OUTPUT:-


eclipse-workspace - Pass2_of_two_pass/src/pass1macro/pass1macro.java - Eclipse IDE
File Edit Source Refactor Navigate Search Project Run Window Help
Package Explorer
pass1
Pass2_of_two_pass
JRE System Library [Java
src
dinning
pass1macro
pass1macro.java
pass2
ReaderWriter
module-info.java
readerwriter.java
pass1macro.java
pass2.java
Main.java
1 package pass1macro;
Problems Javadoc Declaration Console
<terminated> pass1macro [Java Application] C:\Users\prera\.p2\pool\plugins\org.eclipse.justj.openjdk.hotspot.jre.full.win32.x86_64_17.0.5.v20221102-0933\jre\bin\javaw.exe
MNT
Index Name MDT_Index
0 INCR 0
1 ADDS 5
2 ADDS 11
MDT
Index Definition
0 INCR &A &REG
1 MOVER REG &B
2 SUBS #1 &B
3 MOVEM #3 #1
4 MEND
5 ADDS &F &S
6 MOVER AREG #1
7 MULT AREG #2
8 MOVEM AREG #2
9 WRITE #2
10 MEND
11 ADDS &S
12 MOVER AREG &F
13 SUB BREG &F
14 MOVEM BREG #2
15 WRITE #2
16 MEND
Outline
pass1macro
MNT
index : int
name : String
def_index : int
MNT(int, String, int)
MDT
index : int
def : String[]
MDT()
print() : void
pass1macro
main(String[]) : void

Pass II Macro Processor

```
package pass2;

class MNT{
	int index;
	String name;
	int def_index;

	MNT(int i, String a, int j){
		index=i;
		name=a;
		def_index=j;
	}
}

class MDT{
	int index;
	String def[];
		MDT(int i, String m, String op1, String op2, String op3){
			def = new String[4];

			def[0]=m;
			def[1]=op1;
			def[2]=op2;
			def[3]=op3;
		}
}

public class pass2{
	public static void main(String args[]) {
		String input[][]= {{null,"START",null,"200",null},
				{null,"READ","N1", null, null},
				{null,"READ","N2", null, null},
				{null,"ADDS","N1","N2", null},
				{null,"SUBS","N1","N2", null},
				{null,"INCR","N1","N2","DREG"},
				{null, "STOP", null, null, null},
				{"N1","DS","2", null, null},
				{"N2","DS","2", null, null},
				{null, "END", null, null, null}};

		MNT n[]= new MNT[20];
		MDT d[]= new MDT[20];

		n[0]=new MNT(0,"INCR",0);
		n[1]=new MNT(1,"ADDS",5);
		n[2]=new MNT(2,"SUBS",11);
		int nc=3;

		d[0]=new MDT(0,"INCR","&A","&B","&REG");
		d[1]=new MDT(1,"MOVER","#3","#1",null);
		d[2]=new MDT(2,"ADDS","#1","#2",null);
```

```
d[3]=new MDT(3,"MOVEM","#3","#1",null);
d[4]=new MDT(4,"MEND",null,null,null);
d[5]=new MDT(5,"ADDS","&F","&S",null);
d[6]=new MDT(6,"MOVER","AREG","#1",null);
d[7]=new MDT(7,"ADD","AREG","#2",null);
d[8]=new MDT(8,"MOVEM","AREG","#2",null);
d[9]=new MDT(9,"WRITE","#2",null,null);
d[10]=new MDT(10,"MEND",null,null,null);
d[11]=new MDT(11,"SUBS","&F","&S",null);
d[12]=new MDT(12,"MOVER","BREG","#1",null);
d[13]=new MDT(13,"SUB","BREG","#2",null);
d[14]=new MDT(14,"MOVEM","BREG","#2",null);
d[15]=new MDT(15,"WRITE","#2",null,null);
d[16]=new MDT(16,"MEND",null,null,null);
int dc =17;

String output[][],arr1,arr2,arr3,arr4,arr5,op1,op2,op3;
output = new String[dc+input.length][5];

int i=0,j=0,k=0;

while(i<input.length) {
	j=0;
	arr1 = arr2 = arr3 = arr4 = arr5 = null;

	if(input[i][1]!=null)
		arr2=input[i][1];

	for(j=0;j<nc;j++) {
		if(arr2.equals(n[j].name)) {
			break;
		}
	}

	if(j<nc) {
		if(input[i][0]!=null)
			arr1=input[i][0];
		if(input[i][2]!=null)
			arr3=input[i][2];
		if(input[i][3]!=null)
			arr4=input[i][3];
		if(input[i][4]!=null)
			arr5=input[i][4];

		j=n[j].def_index;
		j++;

		if(arr1!=null)
			output[k][0]=arr1;

		while(!d[j].def[0].equals("MEND")){
			op1=d[j].def[1];
			op2=d[j].def[2];
			op3=d[j].def[3];
```

```
                                        if(d[j].def[0]!=null)
                                                output[k][1]=d[j].def[0];
                                        if(d[j].def[1]!=null) {
                                                if(d[j].def[1].equals("#1"))
                                                        op1=arr3;
                                                else if(d[j].def[1].equals("#2"))
                                                        op1=arr4;
                                                else if(d[j].def[1].equals("#3"))
                                                        op1=arr5;
                                        }if(d[j].def[2]!=null) {
                                                if(d[j].def[2].equals("#1"))
                                                        op2=arr3;
                                                else if(d[j].def[2].equals("#2"))
                                                        op2=arr4;
                                                else if(d[j].def[2].equals("#3"))
                                                        op2=arr5;
                                        }if(d[j].def[3]!=null) {
                                                if(d[j].def[3].equals("#1"))
                                                        op3=arr3;
                                                else if(d[j].def[3].equals("#2"))
                                                        op3=arr4;
                                                else if(d[j].def[3].equals("#3"))
                                                        op3=arr5;
                                        }

                                        output[k][2]=op1;
                                        output[k][3]=op2;
                                        output[k][4]=op3;

                                        k++;
                                        j++;

                                }
                                i++;

                        }else {
                                output[k]=input[i];
                                i++;
                                k++;
                        }
                }

                for(i=0;i<output.length;i++) {
                        print(output[i][0],output[i][1],output[i][2],output[i][3],output[i][04]);
                                System.out.println();
                        }
                }

        static void print(String a,String b,String c,String d,String e) {
                if(a!=null)
                        System.out.print(a);
                System.out.print("\t");
                if(b!=null)
                        System.out.print(b);
                System.out.print("\t");
```

```
                if(c!=null)
                        System.out.print(c);
                System.out.print("\t");
                if(d!=null)
                        System.out.print(d);
                System.out.print("\t");
                if(e!=null)
                        System.out.print(e);
                System.out.print("\t");
        }
}
```

OUTPUT:-