



**LAMPIRAN**

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uses dos, crt;
const max      = 25;
garis         = '-----';
takhingga     = 5000;

type larik     = array[1..MAX,1..MAX] of word;
   larik2      = array[1..MAX,1..MAX,1..40] of word;

var MatTetangga,
    MatJalur,
    MatBeban,
    MatBebanMin,
    Mtump      : larik;
    TABLE     : larik2;
    Ukuran     : byte;

{++++ PROSEDUR UNTUK INISIALISASI MatriK +++++}
Procedure InitMatrix(var M : larik);
var I,J : byte;
Begin
  For I := 1 to max do
    For J := 1 to max do
      M[I,J] := 0;
End;

{++++ PROSEDUR UNTUK MEMBACA DATA +++++}
Procedure BacaData(var MatBantu1,Matbantu2 : Larik; N : Byte);
Var I,J : byte;
    Data : integer;
    T1,T2,B : integer;

Begin
  writeln('PROGRAM UNTUK MENGHITUNG BIAYA MINIMAL PADA JARINGAN TRANSPORTASI');
  writeln('DENGAN MENGGUNAKAN ALG. WARSHALL');
  writeln('+++++');
  writeln;
  write('Berapa ukuran Titiknya : '); readln(ukuran);
  write('Berapa Banyak datanya : '); readln(data);
  writeln;
  For I := 1 to data do
    Begin
      writeln(' Masukkan data ke- ',I,' (t1,t2,B) : ');
      gotoxy(wherex+35,wherex-1);readln(t1);
      gotoxy(wherex+40,wherex-1);readln(t2);
      gotoxy(wherex+45,wherex-1);readln(B);
      MatBantu1[T1,T2] := 1;
      MatBantu2[t1,t2] := B;
    end;
end;

{++++ PROSEDUR UNTUK MENENTUKAN MatriK TETANGGA/BEBAN +++++}
Procedure MatrixTetangga(var MT,ME : larik; var ukuran : byte);
var I,J : byte;
    T1,T2,B : integer;
Begin
  For I := 1 to Ukuran do
    For J := 1 to Ukuran do
      Begin

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    MT[I,J] := MatTetangga[I,J];
    MB[I,J] := MatBeban[I,J];
end;
End;

{++++ FUNGSI UNTUK MENGOPERASIKAN OPERATOR OR +++++}
Function OpOr(P1,P2 : byte): byte;
begin
    If (P1 = 0) And (P2 = 0) then OpOr := 0
    else OpOr := 1
end;

{++++ FUNGSI UNTUK MENGOPERASIKAN OPERATOR AND +++++}
Function OpAnd(P1,P2 : byte): byte;
begin
    If (P1 = 1) And (P2 = 1) then OpAnd := 1
    else OpAnd := 0
end;

{++++ FUNGSI UNTUK Mencari Nilai Terkecil dari Dua Bilangan +++++}
Function Minimum(P1,P2 : word) : word;
Begin
    If P1<P2 then Minimum := P1
    Else Minimum := P2
end;

{++++ PROSEDUR UNTUK MENENTUKAN Matrik Lintasan +++++}
Procedure MatrixJalur(Var MJ,MT : larik; N : byte);
var I,J,K : byte;

Begin
    For I := 1 to N do
        For J := 1 to N do
            If MT[I,J] = 0 then MJ[I,J] := 0
            else MJ[I,J] := 1;

            For K := 1 to N do
                For I := 1 to N do
                    For J := 1 to N do
                        MJ[I,J] := OpOr(MJ[I,J] , OpAnd (MJ[I,K] ,MJ[K,J]));
                    end;
                end;
            end;
        end;
    end;
End;

{++++ PROSEDUR UNTUK MENENTUKAN BIAYA MINIMAL +++++}
Procedure MatrixBebanMinimal(var MBM,MB : larik; N : byte);
var I,J,K : byte;

Begin
    For I := 1 to N do
        For J := 1 to N do
            If MB[I,J] = 0 then MBM[I,J] := Takhingga
            else MBM[I,J] := MB[I,J];

            For K := 1 to N do
                Begin
                    For I := 1 to N do

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        For J := 1 to N do
            MBM[I,J] := MINIMUM(MBM[I,J],MBM[I,K]+MBM[K,J]);
        End;
    End;

End;

{++++ PROSEDURE UNTUK MENENTUKAN VERTEK YANG MEMBENTUK LINTASAN +++++}
Procedure LINTASAN(var MBM,MB,Mtump : larik; var Tabel1 :larik2; N : byte);
var I,J,K,L,M,X,Y : byte;

Begin
    For I := 1 to N do
        For J := 1 to N do
            If MB[I,J] = 0 then MBM[I,J] := Takhingga
            else MBM[I,J] := MB[I,J];

        For I := 1 to N do
            For J := 1 to N do
                Mtump[I,J] := 1;

        For I := 1 to N do
            For J := 1 to N do
                Tabel1[I,J,1] :=I;

        Begin
            For K := 1 to N do
                Begin
                    For I := 1 to N do
                        Begin
                            For J := 1 to N do
                                Begin
                                    m := Mtump[I,J]; m := m+1;
                                    X := MBM[I,J]; Y := MBM[I,K] + MBM[K,J];
                                    MBM[I,J] := MINIMUM(X, Y);
                                    L := MINIMUM(X, Y);
                                    If L = X then
                                        Begin
                                            if Mattetangga[I,J] <> 0 then
                                                begin
                                                    If J <> Table[I,J,m-1] then
                                                        begin
                                                            Tabel1[I,J,m] := J;
                                                            Mtump[I,J] := m;
                                                        end
                                                    else
                                                        Mtump[I,J] := m-1;
                                                    end
                                                end
                                            else
                                                Mtump[I,J] := m-1;
                                            end
                                        End
                                    else
                                        if (mattetangga[k,j] or mattetangga[i,k]) <> 0 then
                                            BEGIN
                                                If Table[I,J,m-1] <> K then
                                                    Begin
                                                        Tabel1[I,J,M] := K ; m := m + 1;
                                                        Tabel1[I,J,M] := J ; Mtump[I,J] := m;
                                                    end
                                                end
                                            else

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Mtump[I,J] := m-1;
END;
end;
end;
end;
End;

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{++++ PROSEDUR MENCETAK MATRIK +++++}
Procedure CetakMatrix(M : Larik; N : byte);
var I,J : byte;
Begin
write(' ':6);
For I := 1 to N do
write(I:5); writeln('');

write(' ':5);
For I := 1 to N+1 do
write(garis);writeln('');

For I := 1 to N do
Begin
write(I:5,'|');
For J := 1 to N do
write(M[I,J] : 5);
writeln('');
end;
end;

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{++++ PROSEDUR UNTUK MENCETAK VERTEK YANG MEMBENTUK LINTASAN +++++}
Procedure CetakHasil(Table: larik2; mtump:larik; N: byte);
var I,J,K : byte;

Begin
Writeln(' BIAYA MINIMAL PADA JARINGAN TRASPORTASI ');
Writeln(' DENGAN MENGGUNAKAN ALG. WARSHALL ');
Writeln(' ++++++');
writeln;
writeln('KOTA | LINTASAN ');
writeln('_____');

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For I := 1 to N do
For J := 1 to N do
begin
write(I,J:5,'|');
For K := 1 to mtump[i,j] do
write(table[i,j,k]:2);
writeln('');
end;
end;

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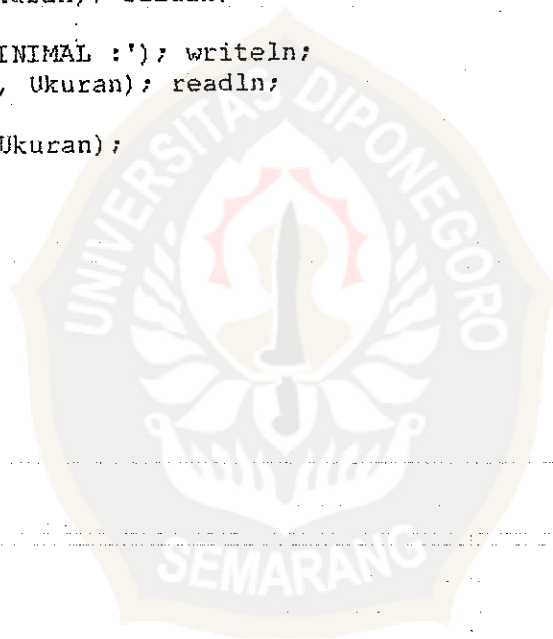
end;
Begin
clrscr;
InitMatrix(MatTetangga);
InitMatrix(MatJalur);
InitMatrix(MatBeban);
BacaData(MatTetangga,MatBeban,Ukuran);writeln;writeln;
MatrixTetangga(MatTetangga,MatBeban,Ukuran);
MatrixJalur(MatJalur, MatTetangga, ukuran);

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LINTASAN(MatBebanMin,MatBeban,Mtump,Table, Ukuran);  
MatrixBebanMinimal(MatBebanMin, MatBeban, Ukuran);  
Normalkan(MatBebanMin, Ukuran);
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{ PENCETAKAN HASIL PERHITUNGAN}
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clrscr;  
writeln('Matrik Tetangga : '); writeln;  
CetakMatrix(MatTetangga, Ukuran); readln;  
clrscr;  
writeln('Matrik Lintasan : '); writeln;  
CetakMatrix(MatJalur, Ukuran); readln;  
clrscr;  
writeln('Matrik Biaya : '); writeln;  
CetakMatrix(MatBeban, ukuran); readln;  
clrscr;  
writeln('Matrik Biaya Minimal :'); writeln;  
CetakMatrix(MatBebanMin, Ukuran); readln;  
clrscr;  
CetakHasil(Table,mtump, Ukuran);  
readln  
end.
```



PROGRAM UNTUK MENSHITUNG BIAYA MINIMAL PADA JARINGAN TRANSPORTASI  
DENGAN MENGGUNAKAN ALG. WARSHALL

+++++  
Berapa ukuran Titiknya : 4  
Berapa Banyak datanya : 5

Masukkan data ke- 1 (t1,t2,B) : 1 2 45  
Masukkan data ke- 2 (t1,t2,B) : 2 1 23  
Masukkan data ke- 3 (t1,t2,B) : 2 3 54  
Masukkan data ke- 4 (t1,t2,B) : 3 4 12  
Masukkan data ke- 5 (t1,t2,B) : 4 1 19

MATRIK TETANGGA :

	1	2	3	4
1:	0	1	0	0
2:	1	0	1	0
3:	0	0	0	1
4:	1	0	0	0

MATRIK BIAYA :

	1	2	3	4
1:	0	45	0	0
2:	23	0	54	0
3:	0	0	0	12
4:	19	0	0	0

MATRIK LINTASAN :

	1	2	3	4
1:	1	1	1	1
2:	1	1	1	1
3:	1	1	1	1
4:	1	1	1	1

MATRIK BIAYA MINIMAL :

	1	2	3	4
1:	68	45	99	111
2:	23	68	54	66
3:	31	76	130	12
4:	19	64	118	130

BIAYA MINIMAL PADA JARINGAN TRANSPORTASI  
DENGAN MENGGUNAKAN ALG. WARSHALL

+++++  
KOTA : LINTASAN

1 1: 1  
1 2: 1 2  
1 3: 1 2 3  
1 4: 1 3 4  
2 1: 2 1  
2 2: 2 1 2  
2 3: 2 3  
2 4: 2 3 4  
3 1: 3 4 1  
3 2: 3 4 2  
3 3: 3  
3 4: 3 4  
4 1: 4 1  
4 2: 4 1 2  
4 3: 4 2 3  
4 4: 4 3 4