

## LAMPIRAN A

### FUNGSI MATLAB "VERT\_2EXP\_LOOPS"

```
function hasil=twoexp(sizes)
baris=sizes; kolom=sizes;
batas=baris^4;
A=zeros(sizes);
A(1,baris)=1;A(1,1)=1;A(3,1)=1;
for i=baris:-1:4
    A(i,i-1)=1;
end
B=zeros(sizes);
B(3,2)=1;B(2,2)=1;B(2,baris)=1;
hasils=zeros(5,baris);
for k=1:baris
    hasils(1,k)=k;
end
ganjil=[A B];
genap=[A^2 A*B+B*A B^2];
yes=0;
for level=3:batas
    sizehurwitz=(level+1)*baris;
    kontrol=mod(level,2);
    cek_positif=zeros(baris,kolom);
    if kontrol==1
        ganjil=zeros(baris,sizehurwitz);
        for kanan = 1:level+1
            btskanan = kanan * baris;
```

```

btskiri= btskanan - baris + 1;
if kanan ==1
    ganjil(:,btskiri:btskanan)=A^level;
elseif kanan==level+1
    ganjil(:,btskiri:btskanan)=B^level;
else
    ganjil(:,btskiri:btskanan)=A*genap(:,btskiri:btskanan)+
    B*genap(:,btskiri-baris:btskanan-baris);
end
ganjil=biner(ganjil);
cek_positif = ganjil(:,btskiri:btskanan);
for brs_cek=1:baris
    if (hasils(4,brs_cek)==0 & cek_positif(brs_cek,:)>0)
        hasils(2:4,brs_cek)=[level-kanan+1;kanan-1;level];
    end
end
if cek_positif >0
    blue = kanan-1; red = level - blue;
    hasils(5,:)=level;
    yes=1;
    break;
end
end
else
genap=zeros(baris,sizehurwitz);
for kanan =1: level+1
    btskanan = kanan * baris;
    btskiri= btskanan - baris + 1;
    if kanan ==1

```

```

        genap(:,btskiri:btskanan)=A^level;
elseif kanan==level+1
        genap(:,btskiri:btskanan)=B^level;
else
        genap(:,btskiri:btskanan)=A*ganjil(:,btskiri:btskanan)+
        B*ganjil(:,btskiri-baris:btskanan-baris);
end
genap=biner(genap);
cek_positif = genap(:,btskiri:btskanan);
for brs_cek=1:baris
        if (hasils(4,brs_cek)==0 & cek_positif(brs_cek,:)>0)
                hasils(2:4,brs_cek)=[level-kanan+1;kanan-1;level];
        end
end
if cek_positif >0
        blue = kanan-1; red = level - blue;
        hasils(5,:)=level;
        yes=1;
        break;
end
end
end
if yes==1
        break;
end
end
hasil=hasils;

```

```
function output=biner(A)
[baris,kolom]=size(A);
for i=1:baris
    for j=1:kolom
        if A(i,j)>0
            A(i,j)=1;
        end
    end
end
output=A;
```

## LAMPIRAN B

### OUTPUT DARI FUNGSI MATLAB "VERT\_2EXP\_LOOPS"

```
>> vert_2exp_loops (3)
```

```
ans =
```

```
1 2 3
2 2 2
2 2 2
4 4 4
4 4 4
```

```
>> vert_2exp_loops (4)
```

```
ans =
```

```
1 2 3 4
4 4 4 5
2 2 2 2
6 6 6 7
7 7 7 7
```

```
>> vert_2exp_loops (5)
```

```
ans =
```

```
1 2 3 4 5
6 6 6 7 8
2 2 2 2 2
8 8 8 9 10
10 10 10 10 10
```

```
>> vert_2exp_loops (6)
```

```
ans =
```

1	2	3	4	5	6
8	8	8	9	10	11
2	2	2	2	2	2
10	10	10	11	12	13
13	13	13	13	13	13

```
>> vert_2exp_loops (10)
```

```
ans =
```

1	2	3	4	5	6	7	8	9	10
16	16	16	17	18	19	20	21	22	23
2	2	2	2	2	2	2	2	2	2
18	18	18	19	20	21	22	23	24	25
25	25	25	25	25	25	25	25	25	25

```
>> vert_2exp_loops (11)
```

```
ans =
```

1	2	3	4	5	6	7	8	9	10	11
18	18	18	19	20	21	22	23	24	25	26
2	2	2	2	2	2	2	2	2	2	2
20	20	20	21	22	23	24	25	26	27	28
28	28	28	28	28	28	28	28	28	28	28