Lampiran 1: Mengubah Bentuk Umum Ke Bentuk Kanonik Karmarkar

```
function [a,B,C]= kanonik(c, A, b);
%mengubah bentuk umum ke bentuk kanonik
%input: A matriks kendala bentuk umum
%       c koefisien pada fungsi objektif bentuk umum
%       b konstanta fungsi kendala
[s,t]=size(A);
x_0=ones(t,1);
lamda_0=ones(s,1);
u_0=ones(t,1);
v_0=ones(s,1);
XX=[transpose(x_0),transpose(lamda_0),transpose(u_0),transpos
e(v_0),1];
CC=[zeros(1,(2*s)+(2*t)),1];
AA=[transpose(c), -transpose(b), zeros(1,t), zeros(1,s),...
    (-transpose(c)*x_0+transpose(b)*lamda_0); A,...
    zeros(s,s), zeros(s,t), -eye(s),(b-
A*x_0+v_0);zeros(t,t),...
    transpose(A), eye(t), zeros(t,s), (c-
transpose(A)*lamda_0)];
BB=transpose([0,transpose(b),transpose(c)]);
a=[AA,-BB];
B=zeros(s+t+1,1);
C=[zeros(2*s+2*t,1);1;0];
```

Lampiran 2: Algoritma Karmarkar untuk Meminimalkan

```
function [x,opt]= karmarkar_min(c, A, b,q);
%mengubah bentuk umum ke bentuk kanonik
%input: A matriks kendala bentuk umum(berbentuk ≥)
%       c koefisien pada fungsi objektif bentuk umum
%       b konstanta fungsi kendala
%       q kriteria stopping
[s,t]=size(A);
x_0=ones(t,1);
lamda_0=ones(s,1);
u_0=ones(t,1);
v_0=ones(s,1);
XX=[transpose(x_0),transpose(lamda_0),transpose(u_0),transpos
e(v_0),1];
CC=[zeros(1,(2*s)+(2*t)),1];
AA=[transpose(c), -transpose(b), zeros(1,t), zeros(1,s),...
    (-transpose(c)*x_0+transpose(b)*lamda_0); A,...
    zeros(s,s), zeros(s,t), -eye(s),(b-
A*x_0+v_0);zeros(t,t),...
    transpose(A), eye(t), zeros(t,s), (c-
transpose(A)*lamda_0)];
BB=transpose([0,transpose(b),transpose(c)]);
a=[AA,-BB];
B=zeros(s+t+1,1);
C=[zeros(2*s+2*t,1);1;0];
%mencari solusioptimal dengan metode karmarkar
%input: a matriks kendala bentuk kanonik
%       C koefisien pada fungsi objektif bentuk kanonik
%output:    x_1 vektor variabel keputusan
%           k banyak iterasi yang dibutuhkan
%langkah 1
alpha=0.25;
k=0;
n=length(a);
a_0=(1/n)*ones(n,1);
x_0=a_0;
%langkah 2
D_0=diag(x_0);
B_0=[a*D_0;ones(1,n)];
P_0=eye(n)-transpose(B_0)*(inv(B_0*transpose(B_0)))*B_0;
ch_0=(P_0*D_0*C)/norm(P_0*D_0*C);
r=1/sqrt(n*(n-1));
d_0=-r*ch_0;
x_bar_1=a_0 +alpha*d_0;
x_1=(D_0*x_bar_1)/(ones(1,n)*D_0*x_bar_1);
%langkah 3
```

```
fx_0=transpose(C)*a_0;
fx_1=transpose(C)*x_1;
while fx_1/fx_0>2^(-q);
    x_0=x_1;
    D_0=diag(x_0);
    B_0=[a*D_0;ones(1,n)];
    P_0=eye(n)-transpose(B_0)*(inv(B_0*transpose(B_0)))*B_0;
    ch_0=(P_0*D_0*C)/norm(P_0*D_0*C);
    r=1/sqrt(n*(n-1));
    d_0=-r*ch_0;
    x_bar_1=a_0 +alpha*d_0;
    x_1=(D_0*x_bar_1)/(ones(1,n)*D_0*x_bar_1);
    fx_1=transpose(C)*x_1;
    k=k+1;
end
x=x_1(1:t,1)/(x_1(n,1));
opt=transpose(c)*x;
```

Lampiran 3: Algoritma Karmarkar untuk Memaksimalkan

```
function [x,opt]= karmarkar_max(c, A, b,q);
%mengubah bentuk umum ke bentuk kanonik
%input: A matriks kendala bentuk umum(berbentuk ≤)
%       c koefisien pada fungsi objektif bentuk umum
%       b konstanta fungsi kendala
%       q kriteria stopping
[s,t]=size(A);
x_0=ones(t,1);
lamda_0=ones(s,1);
u_0=ones(t,1);
v_0=ones(s,1);
XX=[transpose(x_0),transpose(lamda_0),transpose(u_0),transpos
e(v_0),1];
CC=[zeros(1,(2*s)+(2*t)),1];
AA=[transpose(c), -transpose(b), zeros(1,t), zeros(1,s),...
    (-transpose(c)*x_0+transpose(b)*lamda_0); A,...
    zeros(s,s), zeros(s,t), eye(s),(b-A*x_0-
v_0);zeros(t,t),...
    transpose(A), -eye(t), zeros(t,s), (c-
transpose(A)*lamda_0)];
BB=transpose([0,transpose(b),transpose(c)]);
a=[AA,-BB];
B=zeros(s+t+1,1);
C=[zeros(2*s+2*t,1);1;0];
%mencari solusioptimal dengan metode karmarkar
%input: a matriks kendala bentuk kanonik
%       C koefisien pada fungsi objektif bentuk kanonik
%output:    x_1 vektor variabel keputusan
%           k banyak iterasi yang dibutuhkan
%langkah 1
alpha=0.25;
k=0;
n=length(a);
a_0=(1/n)*ones(n,1);
x_0=a_0;
%langkah 2
D_0=diag(x_0);
B_0=[a*D_0;ones(1,n)];
P_0=eye(n)-transpose(B_0)*(inv(B_0*transpose(B_0)))*B_0;
ch_0=(P_0*D_0*C)/norm(P_0*D_0*C);
r=1/sqrt(n*(n-1));
d_0=-r*ch_0;
x_bar_1=a_0 +alpha*d_0;
x_1=(D_0*x_bar_1)/(ones(1,n)*D_0*x_bar_1);
```

```
%langkah 3
fx_0=transpose(C)*a_0;
fx_1=transpose(C)*x_1;
while fx_1/fx_0>2^(-q);
    x_0=x_1;
    D_0=diag(x_0);
    B_0=[a*D_0;ones(1,n)];
    P_0=eye(n)-transpose(B_0)*(inv(B_0*transpose(B_0)))*B_0;
    ch_0=(P_0*D_0*C)/norm(P_0*D_0*C);
    r=1/sqrt(n*(n-1));
    d_0=-r*ch_0;
    x_bar_1=a_0 +alpha*d_0;
    x_1=(D_0*x_bar_1)/(ones(1,n)*D_0*x_bar_1);
    fx_1=transpose(C)*x_1;
    k=k+1;
end
x=x_1(1:t,1)/(x_1(n,1));
opt=transpose(c)*x;
```

Lampiran 4: Contoh 1

$$\begin{aligned} \text{minimalkan} \quad & 3x_1 + x_2 \\ \text{dengan kendala} \quad & 2x_1 - x_2 \geq 2 \\ & x_1 + 2x_2 \geq 5 \\ & x_1, x_2 \geq 0 \end{aligned}$$

```
>> c=[3;1]
c =

     3
     1

>> A=[2 -1;1 2]

A =

     2    -1
     1     2

>> b=[2;5]

b =

     2
     5

>> q=100

q =

   100

>> [x,opt]=karmarkar_min(c, A, b,q)

x =

    1.8000
    1.6000


opt =

    7.0001
```

Lampiran 5: Contoh 2

maksimalkan $2x_1 + 3x_2$

dengan kendala

$$x_1 + x_2 \leq 5$$

$$3x_1 + 8x_2 \leq 24$$

$$x_1, x_2 \geq 0$$

```
>> c=[2;3]

c =

     2
     3

>> A=[1 1;3 8]

A =

     1     1
     3     8

>> b=[5;24]

b =

     5
    24

>> [x,opt]= karmarkar_max(c, A, b,q)

x =

    3.2000
    1.8000


opt =

   11.7999
```

Lampiran 6: Contoh 3

maksimalkan $250x_1 + 500x_2$

dengan kendala

$$x_1 + x_2 \le 120$$

$$x_1 + 4x_2 \le 240$$

$$x_1, x_2 \ge 0$$

```
>> A=[1 1;1 4]

A =

     1     1
     1     4

>> b=[120;240]

b =

   120
   240

>> c=[250;500]

c =

   250
   500

>> q=50

q =

    50

>> [x,opt]= karmarkar_max(c, A, b,q)

x =

   79.9863
   39.9932

opt =

  3.9993e+004
```