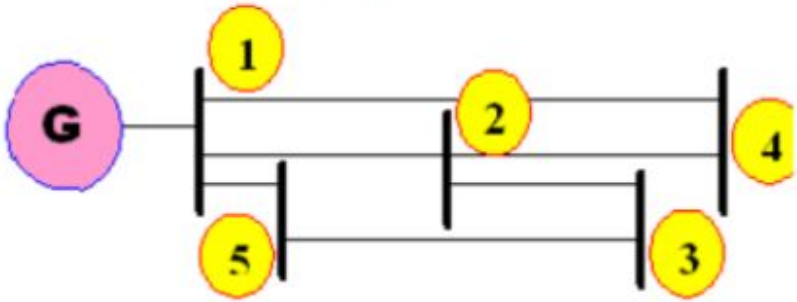
Problem 1 :

For the power system shown in fig. below, with the data as given in tables below, obtain the bus voltages at the end of first iteration, by applying GS method.



Power System of Example 2

Line data of example 2

SB	EB	R (pu)	X (pu)	$\frac{B_C}{2}$
1	2	0.10	0.40	-
1	4	0.15	0.60	-
1	5	0.05	0.20	-
2	3	0.05	0.20	-
2	4	0.10	0.40	-
3	5	0.05	0.20	-

Bus data of example 2

Bus No.	P_G (pu)	Q_G (pu)	P_D (pu)	Q_D (pu)	$\lvert V_{SP}\rvert$ (pu)	δ
1	-	-	-	-	1.02	0^o
2	-	-	0.60	0.30	-	-
3	1.0	-	-	-	1.04	-
4	-	-	0.40	0.10	-	-
5	-	-	0.60	0.20	-	-

MD. MAHBUB ALI

```
clc
clear all
close all

% Impedence
z12 = 0.10+0.40i;
z14 = 0.15+0.60i;
z15 = 0.05+0.20i;
z23 = 0.05+0.20i;
z24 = 0.10+0.40i;
z35 = 0.05+0.20i;

% Admittance
y12 = 1/z12 ;
y14 = 1/z14 ;
y15 = 1/z15 ;
y23 = 1/z23 ;
y24 = 1/z24 ;
y35 = 1/z35 ;

y11 = y12+y14+y15;
y22= y12+y23+y24;
y33= y23+y35;
y44= y14+y24;
y55 = y15+y35;
```

```
% Y Bus Matrix

 y12=-y12;
 y14=-y14;
 y15=-y15;
 y23=-y23;
 y24=-y24;
 y35=-y35;

p2=-0.6;
q2=-0.3i;
p3=1;
%q3= not given;
p4=-0.4;
q4=-0.1;
p5=-0.6;
q5=-0.2;


v1=1.02+0i;
v2=1+0i;
v3=1.04;
v4=1+0i;
v5=1+0i;
```

```
for k = 0:1  % iteration number

    iter = iter +1
    v2  = ((p2-q2)/conj(v2)-(y12*v1)-(y23*v3)-(y24*v4))/(y22)
    v22 = [abs(v2)   (angle(v2))*(180/pi)]

    q3 = (-imag((v3*v2*y23)+(v3*v5*y35)+(v3*v3*y33)))*i % Q3 need to be determined

    v3 = (((p3-q3)/conj(v3))-((y23*v2)+(y35*v5)))/(y33)
    v33= [abs(1.04)   (angle(v3))*(180/pi)] % show in Polar Form
    v4 = (((p4-q4)/conj(v4))-((y14*v1)+(y24*v2)))/(y44)
    v44= [abs(v4)   (angle(v4))*(180/pi)]
    v5 = (((p5-q5)/conj(v5))-((y35*v3)+(y15*v1)))/(y55)
    v55= [abs(v5)   (angle(v5))*(180/pi)]

end
```

MD. MAHBUB ALI

```
iter =
     1
v2 =
   0.9800 - 0.0525i
v22 =
    0.9814   -3.0665
q3 =
   0.0000 + 0.4252i
v3 =
   1.0549 + 0.0597i
v33 =
    1.0400    3.2381
```

```
v4 =
   0.9780 - 0.1035i
v44 =
    0.9835   -6.0410
v5 =
   1.0275 - 0.0102i
v55 =
    1.0275   -0.5665
```

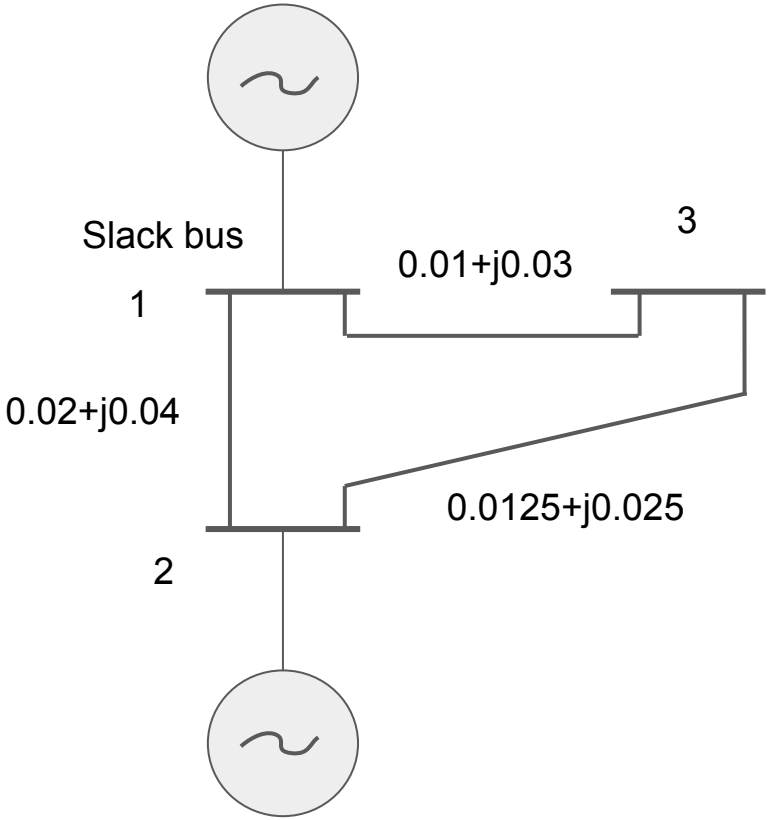
Problem 2 : Schedule generation and loads and assumed bus voltage for sample power system

		Generation		LOAD	
Bus Code (i)	Assumed bus voltage	MW	MV/Ar	MW	MV/Ar
		Pg	Qg	P_L	Q_L
1 (slack bus)	1.05+j0	-	-	0	0
2	1.0+j0	50	30	305.6	140.2
3	1.0+j0	0	0	138.6	45.2

Bus Code (i - k)	Impedance, Zik
1-2	0.02+j0.04
1-3	0.01+j0.03
2-3	0.0125+j0.025

Base MVA = 100

MD. MAHBUB ALI




```
clc
clear all
close all

%Schedule generation and loads and assumed bus voltage for sample power
%system

% Impedence
z12 = 0.02+0.04i;
z13 = 0.01+0.03i;
z23 = 0.0125+0.025i;


% Admittance
y12 = 1/z12 ;
y13 = 1/z13 ;
y23 = 1/z23 ;

y11 = y12+y13;
y22=y12+y23;
y33=y13+y23;

y12=-y12;
y13=-y13;
y23=-y23;

p2=-2.556; % (Pg/100)-(PL/100)
q2=-1.102i;
p3=-1.386;
q3=-0.452i;

v1=1.05;
v2=1+0i;
v3=1+0i;
```

MD. MAHBUB ALI

```
iter = 0;


for k = 0:1 %required iteration number

    iter = iter +1

    v2 = (((p2-q2)/conj(v2)-(y12*v1)-(y23*v3)))/(y22)
    v22 = [abs(v2)   (angle(v2))*(180/pi)]
    v3 = (((p3-q3)/conj(v3))-((y13*v1)+(y23*v2)))/(y33)
    v33= [abs(v3)   (angle(v3))*(180/pi)] % showing in Polar Form

end
```

```
iter =
     1
v2 =
   0.9826 - 0.0308i
v22 =
    0.9831   -1.7980
v3 =
   1.0011 - 0.0352i
v33 =
    1.0018   -2.0123
iter =
     2
v2 =
   0.9817 - 0.0518i
v22 =
    0.9831   -3.0226
v3 =
   1.0009 - 0.0458i
v33 =
    1.0019   -2.6211
```

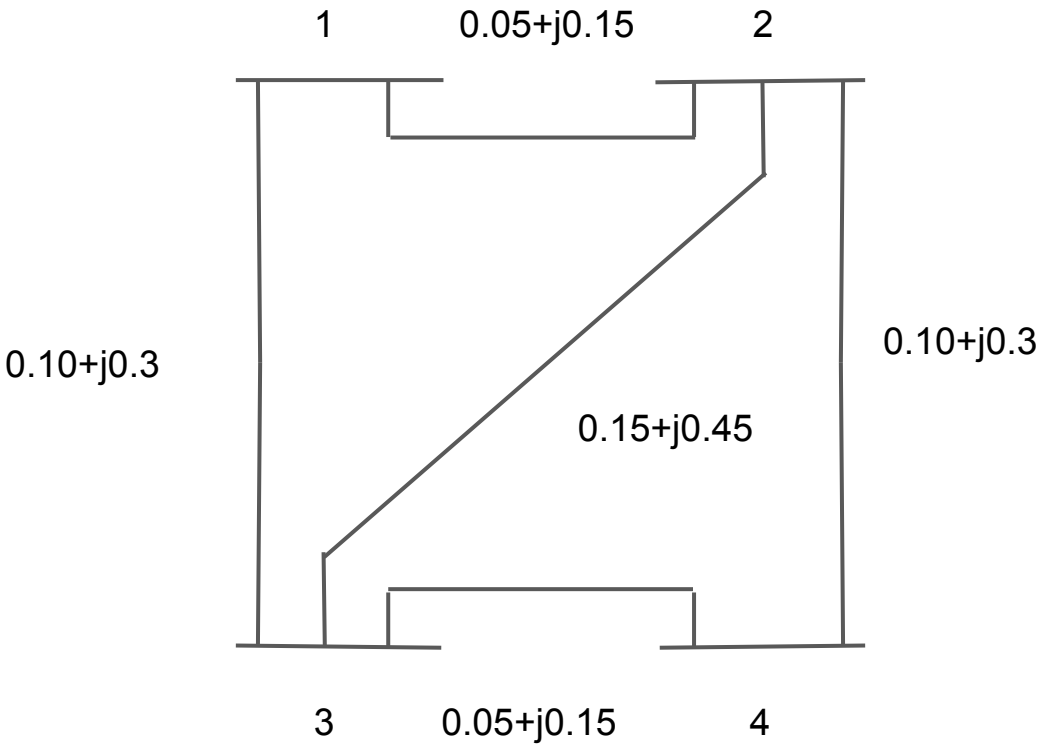
MD. MAHBUB ALI

Problem 3:
For the power system shown in fig. below, with the data as given in tables below, obtain the bus voltages at the end of first iteration, by applying GS method.

Bus	Pp (p.u.)	Qp(pu)	Vp(pu)	Remarks
1	-	-	1.04<0°	Slack bus
2	0.5	-0.2	-	PQ Bus
3	-1.0	0.5	-	PQ Bus
4	0.3	-0.1	-	PQ Bus

Line (bus to bus)	R(pu)	X(pu)
1-2	0.05	0.15
1-3	0.10	0.30
2-3	0.15	0.45
2-4	0.10	0.30
3-4	0.05	0.15

MD. MAHBUB ALI



MD. MAHBUB ALI

```
clc
clear all
close all
%For the power system shown in fig., with the data as given in tables below,
%obtain the bus voltages at the end of first iteration, by applying GS method.


% Impedence
z12 = 0.05+0.15i;
z13 = 0.10+0.30i;
z23 = 0.15+0.45i
z24 = 0.10+0.30i
z34 = 0.05+0.15i

% Admittance
y12 = 1/z12 ;
y13 = 1/z13 ;
y23 = 1/z23 ;
y24 = 1/z24 ;
y34 = 1/z34 ;
```

```
y11 = y12+y13;
y22=y12+y23+y24;
y33=y13+y23+y34;
y44=y34+y24;


%Y BUS MATRIX

y12=-y12;
y13=-y13;
y23=-y23;
y24=-y24;
y34=-y34;
```

```
p2=0.5;
q2=-0.2i;
p3=-1;
q3=0.5i;
p4=0.3;
q4=-0.1;

v1=1.04+0i;
v2=1+0i;
v3=1+0i;
v4=1+0i;
```

MD. MAHBUB ALI

```
iter = 0;

for k = 0:1

    iter = iter +1

    v2 = ((p2-q2)/conj(v2)-((y12)*v1)-(y23*v3)-(y24*v4))/(y22)
    v22 = [abs(v2)   (angle(v2))*(180/pi)]
    v3 = (((p3-q3)/conj(v3))-((y13*v1)+(y23*v2)+(y34*v4)))/(y33)
    v33= [abs(v3)   (angle(v3))*(180/pi)]
    v4 = (((p4-q4)/conj(v4))-((y34*v3)+(y24*v2)))/(y44)
    v44= [abs(v4)   (angle(v4))*(180/pi)]

end
```

```
y12 =
   2.0000 - 6.0000i
y13 =
   1.0000 - 3.0000i
y23 =
   0.6667 - 2.0000i
y24 =
   1.0000 - 3.0000i
y34 =
   2.0000 - 6.0000i
```

```
iter =
     1
v2 =
   1.0191 + 0.0464i
v22 =
    1.0201    2.6049
v3 =
   1.0280 - 0.0870i
v33 =
    1.0317   -4.8387
v4 =
   1.0384 - 0.0026i
v44 =
    1.0384   -0.1414
iter =
     2
v2 =
   1.0326 + 0.0288i
v22 =
    1.0330    1.5952
v3 =
   1.0431 - 0.0895i
v33 =
    1.0470   -4.9026
v4 =
   1.0526 - 0.0116i
v44 =
    1.0526   -0.6300
```

MD. MAHBUB ALI