Problem set 1

```
% Initialize variables
alpha=.35;
beta=.98;
delta=.025;
sigma=2;
gamma=5;

k=[2.85; 3.00; 3.15];
v=[167.6; 168.1; 168.6];

% (a)
y=gamma*k.^alpha;
c=(y+(1-delta)*k)*ones(1,3)-ones(3,1)*k';
u=(1/(1-sigma))*(c.^(1-sigma)-1)

% (b)
vs=u+beta*ones(3,1)*v'

% (c)
[v,p]=max(vs,[],2)

% return
%Compute v
epsilon=1e-6;
v_old=0;
while max(abs(v-v_old))>epsilon,
    v_old=v;
    v=max(u+beta*ones(3,1)*v',[],2);
end
 v
```

Extension

```
%This program does the same as ps1.m, except that we can have more than 3
%levels of capital

% Initialize variables
alpha=.35;
beta=.98;
delta=.025;
sigma=2;
gamma=5;

% Here the k-vector is constructed
kmin=10; % Lowest possible level of capital
kmax=400; % Highest possible level of capital
gridp=100; % Number of grid points, i.e. number of elements in k
k=(kmin:(kmax-kmin)/(gridp-1):kmax)';  % Construction of the k-vector

y=gamma*k.^alpha;
c=max((y+(1-delta)*k)*ones(1,gridp)-ones(gridp,1)*k',0);
u=(1/(1-sigma))*(c.^(1-sigma)-1);
v=0*k+10; % Make all elements of v=10 initially

% Value function iteration
epsilon=1e-6;
v_old=0*v;
while max(abs(v-v_old)./max(v,1e3))>epsilon,
```

```
    v_old=v;
    [v,p]=max(u+beta*ones(gridp,1)*v',[],2);
end

% Plot the value function
plot(k,v);
```

Problem set 2, ex. 2

```
alpha=0.2;
rho=0.2;
sigma=.1;
min_r=0.2;
max_r=1.5;

r=linspace(min_r,max_r,100);
% Savings rate
s=((1+r).^(sigma-1))./((1+rho).^sigma+(1+r).^(sigma-1));
% Wage
w=(1-alpha)*(r./alpha).^(-alpha/(1-alpha));
% Savings
s1=s.*w;
% Investment demand
k=(r./alpha).^(-1/(1-alpha));

% Plot for sigma=0.1
plot(r,s1,r,k)

% Generate s for other sigma
for sigma=[.5 1 2 5]
    s=((1+r).^(sigma-1))./((1+rho).^sigma+(1+r).^(sigma-1));
    w=(1-alpha)*(r./alpha).^(-alpha/(1-alpha));
    s1=[s1;s.*w];
end

% Plot all s
plot(k,r,s1,r)
xlabel('k')
ylabel('r')
```

Problem set 2, ex. 3

```
rho=0.04;
u=[20;10;-5];
P=[.55 .40 .05;
   .35 .55 .10;
   .20 .20 .60];

% Direct approach
V=inv(eye(3)-(1/(1+rho))*P)*u

% Value function iteration
eps=1e-6;
V_old=0;
V=u;
i=0;
while (abs((V_old-V)./V))>eps
    V_old=V;
    V=u+(1/(1+rho))*P*V;
```

```
    i=i+1;
end
V
i


% New rho
rho=0.03;
V=inv(eye(3)-(1/(1+rho))*P)*u
```

Problem set 5

```
alpha=.35;
beta=.98;
delta=.025;
sigma=2;

gamma1=4.95;
gamma2=5.05;
gamma_bar=5;

g=800; % Dimension of X
eps=1e-4; % Criterion for value function iteration

% ii.
kstar=(alpha*gamma_bar/((1/beta)-1+delta))^(1/(1-alpha))

% iii.
k_min=0.5*kstar;
k_max=1.5*kstar;
X=linspace(k_min,k_max,g);

% iv.
C1=(gamma1*X'.^(alpha)+(1-delta)*X')*ones(1,g)-ones(g,1)*X;
C2=(gamma2*X'.^(alpha)+(1-delta)*X')*ones(1,g)-ones(g,1)*X;

U1=(C1.^(1-sigma)-1)/(1-sigma);
U1(C1<0)=-Inf;

U2=(C2.^(1-sigma)-1)/(1-sigma);
U2(C2<0)=-Inf;

% v.
v1_old=zeros(g,1);
v2_old=zeros(g,1);

v1=max(U1,[],2);
v2=max(U2,[],2);

% vi.
i=0;
while max(max(abs((v1-v1_old)./v1)), max(abs((v2-v2_old)./v2)))>eps
    v1_old=v1; v2_old=v2;
    v1=max(U1+beta*.5*ones(g,1)*(v1+v2)',[],2);
    v2=max(U2+beta*.5*ones(g,1)*(v1+v2)',[],2);
    i=i+1;
end
i
```

```
% plot(X,[v1 v2])

% vii
[v1,d1]=max(U1+beta*.5*ones(g,1)*(v1+v2)',[],2);
[v2,d2]=max(U2+beta*.5*ones(g,1)*(v1+v2)',[],2);

subplot(2,1,1); plot(X,[X(d1); X(d2)]);
legend('\gamma_1','\gamma_2');
xlabel('k'); ylabel('k`');
subplot(2,1,2); plot(X,[X(d1)-X; X(d2)-X]);
legend('\gamma_1','\gamma_2');
xlabel('k'); ylabel('Increase in k');
```