```
%winter(HBC)
nEV=input('Enter the No of Vehicles: ');
Array_BEV_40PHEV_30PHEV = zeros(1,nEV); % elements 1=>BHEVs 2=>BEVs

%........ BEV=>50%=>'1'____PHEV-40=>30%=>'2'____PHEV-30=>20%=>'3'[HBC]
    for i=1:nEV
       if i<=round(nEV*50/100)
           Array_BEV_40PHEV_30PHEV(i)=1;
       elseif i>round(nEV*50/100) && i<=round(nEV*80/100)
           Array_BEV_40PHEV_30PHEV(i)=2;
       elseif i>round(nEV*80/100) && i<=nEV
           Array_BEV_40PHEV_30PHEV(i)=3;
       end
    end


type=Array_BEV_40PHEV_30PHEV(randperm(length(Array_BEV_40PHEV_30PHEV)));
%Shuffle-> To indicate each element of Array

DM = normrnd(32,6,[1,nEV]);  % Daily Mileage following Normal Distribution
                             % Mean=55, S.D.=10, No of Random Variables
supposed to be generated=10
FTD = normrnd(11,3.41,[1,nEV]);  % 1st Trip Distance following Normal
Distribution

Tin = normrnd(16,1.2,[1,nEV]);  % Arrival Time following Normal Distribution
Tout = normrnd(22,1.2,[1,nEV]); % Departure Time following Normal
Distribution

while max(Tout)>24    % Tout shouldn't go beyond 24hrs
    Tout = normrnd(22,1.2,[1,nEV]);  %if goes, again generates Random
Variable
end

rate_USEP_MWh1 = [97.412       90.391  82.404  77.21   74.109  73.493  73.563
73.115  70.126  70.056  73.479  73.507  74.046  79.198  90.265  97.489  106.26
140.546 146.601 118.867 115.052 106.232 102.473 97.209  90.244  97.503  97.552
64.61   71.113  59.717  93.478  99.967  99.967  101.927 106.19  254.064
280.832 333.344 490.352 490.368 490.288 490.4   378.192 295.696 242.64
228.352 223.184 223.04
```

```
];
rate_USEP_MWh = zeros(nEV,48);
for i=1:nEV
    for j=1:48
         rate_USEP_MWh(i,j)=rate_USEP_MWh1(j);
    end
end

rate_USEP_kWh = rate_USEP_MWh/1000;
%type1 = rate_USEP_kWh(randperm(length(rate_USEP_kWh)));

for i=1:nEV
    % <--------------1st Objective: To Find ENERGY REQ.(of all individual
BHEVs & BEVs)---------------------->
    if type(i)==1  %BEV
        AER=117;
        Bc=24;
    elseif type(i)==2  %PHEV-40
        AER=40*1.6;
        Bc=18.4;
    elseif type(i)==3   %PHEV-30
        AER=30*1.6;
        Bc=13.8;
    end

    STD(i)=DM(i)-FTD(i);
    SOCa(i)=1-FTD(i)/AER;
    SOCd(i)= STD(i)/AER+0.2;
    if SOCd(i)>1
        SOCreq(i)=1-SOCa(i);
    elseif SOCa(i)<SOCd(i) && SOCd(i)<1
        SOCreq(i)=SOCd(i)-SOCa(i);
    elseif SOCd(i)==SOCa(i)
        SOCreq(i)=0;
    elseif SOCd(i)>0.2 && SOCd(i)<SOCa(i)
        SOCreq(i)=-(SOCa(i)-SOCd(i));
    end
    Ereq(i)=SOCreq(i)*Bc/0.9;    % Energy req while Charging----------------
--------
```

```
    % we can use 'disp(Ereq(i));' as well to print values

% <------------2nd Objective: To find TOTAL NO OF SLOTS.----------------->

    if Tin(i)>round(Tin(i))
        Nin(i)=floor(Tin(i))*2+1;
    elseif Tin(i)<round(Tin(i))
        Nin(i)=floor(Tin(i))*2+2;
    end

    if Tout(i)>round(Tout(i))
        Nout(i)=floor(Tout(i))*2+1;
    elseif Tout(i)<round(Tout(i))
        Nout(i)=floor(Tout(i))*2+2;
    end

    Nslot(i)=Nout(i)-Nin(i)+1;  % No of Slots----------------------->


end

cost = zeros(nEV,48);
for i=1:nEV
    fprintf('\n\n\n _____________________Vehicle-%d_____________________\n',i);
    if Ereq(i)<0
        Ereq(i)=Ereq(i)*0.9*0.9; % Energy req while Discharging------------
-----------
    end
    fprintf('Energy Req for Vehicle-%d = %.7f\n',i,Ereq(i));%Print Ereq
Values as Output
    fprintf('Entering Slot of V-%d = %d\n\n',i,Nin(i));
    fprintf('Outgoing Slot of V-%d = %d\n\n',i,Nout(i));
    fprintf('No of Slots for Vehicle-%d = %d\n\n',i,Nslot(i));

    % <------------3rd Objective: Last Slot Adjustment.----------------->
    m=Ereq(i); %---store the value of Energy req in variale 'm'
    condition=true;
     array = zeros(1, Nslot(i));  %.................. to indicate amount of
charging/discharging
     arrayCHorDIS = zeros(1, Nslot(i)); %           to indicate whether
```

```
    arrayCHorDIS = zeros(1, Nslot(i));  %......... to indicate whether
charging(1)/discharging(-1)/idle(0)

    while condition
        total_power = 0; % Initially charged power

    % Loop upto (n-1) slots
        j=0;
        for slot = Nin(i):Nout(i)-1
            j=j+1;
            action = randi([1, 3]);   % 1: charge, 2: discharge, 3: idle

         switch action
            case 1    %---------Charging
                c1=3;  %-------Charging range: 3 to 8kW
                c2=8;
                charge_power = c1+(c2-c1)*rand;  %---------- random
generation
                total_power = total_power + charge_power;
                cost(i,slot)= charge_power;
                array(j)= charge_power;
                arrayCHorDIS(j)=1;   %........charging(1)
                %fprintf('Slot-%d -----> Charging: %f kW.  Total Charged
Power: %.2f kW\n', slot, charge_power, total_power);

            case 2    %.........Discharging
                d1=0;  %-------Discharging range: 0 to 2kW
                d2=2;
                discharge_power = d1+(d2-d1)*rand;  %---------- random
generation
                total_power = total_power - discharge_power;
                cost(i,slot)= -discharge_power;
                array(j)= -discharge_power;
                arrayCHorDIS(j)=-1;   %........Discharging(-1)
                %fprintf('Slot %d -----> Discharging %f kW.  Total Charged
Power: %.2f kW\n', slot, discharge_power, total_power);

             case 3    % Idle
                 array(j)= 0;
                 arrayCHorDIS(j)=0;
```

```
                %fprintf('Slot %d -----> Idle.  Total Power: %.2f kW\n',
slot, total_power);
        end
       end       % End operation of (n-1)th slot

 % nth(last slot) calculation & Range
checking_____________________________________________

    if total_power > m    % DISCHARGING NEEDED
        final_discharged_power = total_power-m;
        if (final_discharged_power>2)
            %fprintf('\n.....NEW SCHEDULE.....\n');
        elseif (final_discharged_power>=1 && final_discharged_power<=2)
             k=0;
             tp=0;
            for slot=Nin(i):Nout(i)-1
                k=k+1;
                if  arrayCHorDIS(k)==1
                     fprintf('Slot-%d -----> Charging: %f kW.  Total Charged
Power: %.2f kW\n', slot, array(k), tp+array(k));
                     tp=tp+array(k);
                elseif arrayCHorDIS(k)==-1
                    fprintf('Slot %d -----> Discharging %f kW.  Total
Charged Power: %.2f kW\n', slot, array(k), tp+array(k));
                    tp=tp+array(k);
                elseif arrayCHorDIS(k)==0
                    fprintf('Slot %d -----> Idle.  Total Power: %.2f kW\n',
slot, tp);
                end
            end
            fprintf('Slot %d(last slot) ----->Need of Discharging,
Discharged Power = %f',Nout(i),final_discharged_power);
            fprintf('\n   So, finally Total Energy Charged = %f kWh\n\n',
(total_power-final_discharged_power));
            cost(i,Nout(i))= -final_discharged_power;
            condition = false;
        end

    elseif total_power<m  % CHARGING NEEDED
        final_charged_power = m-total_power;
```

```
        if (final_discharged_power>8 && final_discharged_power<3)
        %fprintf('\n.....NEW SCHEDULE.....\n');
        elseif (final_charged_power>=3 && final_charged_power<=8)
 % for printing 1st to n-1 slot detals..............
             k=0;
             tp=0;
            for slot=Nin(i):Nout(i)-1
                k=k+1;
                if  arrayCHorDIS(k)==1
                     fprintf('Slot-%d -----> Charging: %f kWh.  Total
Charged Energy: %.2f kWh\n', slot, array(k), tp+array(k));
                     tp=tp+array(k);
                elseif arrayCHorDIS(k)==-1
                    fprintf('Slot %d -----> Discharging %f kWh.  Total
Charged Energy: %.2f kWh\n', slot, array(k), tp+array(k));
                    tp=tp+array(k);
                elseif arrayCHorDIS(k)==0
                    fprintf('Slot %d -----> Idle.  Total Energy: %.2f
kWh\n', slot, tp);
                end
            end

% for printing last slot details..................
            fprintf('Slot %d(last slot) ----->Need of Charging, Charged
Energy = %f kWh',Nout(i),final_charged_power);
            fprintf('\n   So, finally Total Energy charged = %f kWh\n\n',
(total_power+final_charged_power));
            cost(i,Nout(i))= final_charged_power;
            condition = false;
        end
    end
end



end

cost=cost.*rate_USEP_kWh;
disp(cost);

for i=1:nEV
```

```
    sum=0;
    for j=1:48
        sum=sum+cost(i,j);
    end
    fprintf('\n\n Total Cost for Vehicle-%d = %f',i,sum);
end
```