```
> restart: # Shapley-Baron-n3.mw
```
From Barron.
```
>
```

```
> N:={1,2,3}; # Set up the Players.
```
$$N := \{1, 2, 3\} \tag{1}$$

```
> np:=nops(N); # Number of players
```
$$np := 3 \tag{2}$$

```
> with(combinat): # We need this to find all the possible
  coalitions.
> L:=powerset(N):
  M:=convert(L,list); # All possible coalitions
```
$$M := [\{\,\}, \{1\}, \{2\}, \{3\}, \{1, 2\}, \{1, 3\}, \{2, 3\}, \{1, 2, 3\}] \tag{3}$$

```
> K:=nops(L); # Number of coalitions
```
$$K := 8 \tag{4}$$

```
> M:=sort(M,length);
```
$$M := [\{\,\}, \{1\}, \{2\}, \{3\}, \{1, 2\}, \{1, 3\}, \{2, 3\}, \{1, 2, 3\}] \tag{5}$$

The Characteristic function is defined here, coalition by coalition.
```
> for k from 1 to K do
  if nops(M[k])<=1
  then v(M[k]):=0;
  end if;
  end do;
> v({1,2}):=90;
  v({1,3}):=100;
  v({2,3}):=120;
  v({1,2,3}):=220;
```

$$v(\{1, 2\}) := 90$$
$$v(\{1, 3\}) := 100$$
$$v(\{2, 3\}) := 120$$
$$v(\{1, 2, 3\}) := 220 \tag{6}$$

Procedure to calculate Shapley
```
> shapleyval:=proc(v,x,N)
  local i,k,shapley;
  for i from 1 to nops(N) do
  x[i]:=0:
  for k from 1 to K do
   if member(i,M[k]) and nops(M[k])>=1 then
   x[i]:=x[i]+(v(M[k])-v(M[k] minus {i}))*
```

```
                ((nops(M[k])-1)!*(nops(N)-nops(M[k]))!)/nops(N)!
  end if;
 end do;
 lprint(shapley[i]=x[i]);
 end do:
 end proc:


> shapleyval(v,x,N);
shapley[1] = 65
shapley[2] = 75
shapley[3] = 80
```