#include <iostream>

#include <bits/stdc++.h>

using namespace std;

class item{

public:

int weight;

int value;

};

bool sort\_weight(item i1, item i2){

return i1.weight<i2.weight;

}

bool sort\_value(item i1, item i2){

return i1.value>i2.value;

}

bool sort\_density(item i1, item i2){

return i1.value/(float)i1.weight >i2.value/(float)i2.weight;

}

int sort\_helper(item items[],int n,string s){

if(s=="weight")

sort(items,items+n,sort\_weight);

else if(s=="profit")

sort(items,items+n,sort\_value);

else if(s=="density")

sort(items,items+n,sort\_density);

else{

cout<<"Invalid Parameter";

return 0;

}

return 1;

}

void load\_knapsack(int max, item items[], int n, string s){

if (!sort\_helper(items,n,s)) return;

bool\* taken = new bool[n];

for(int i=0;i<n;i++)

taken[i]=false;

int used = max;

int profit=0;

int i=0;

while(i<n){

if((max-items[i].weight)>=0){

max-=items[i].weight;

profit+=items[i].value;

taken[i]=true;

}

else

break;

i++;

}

cout<<"Weight used: "<< used-max<<endl;

cout<<"Profit obtained: "<<profit<<endl;

for(int i=0;i<n;i++)

cout<<"( "<<items[i].weight<<", "<<items[i].value<<" )-> "<<taken[i]<<endl;

}

int main(){

int max;

cout<<"Enter max weight:";

cin>>max;

int n;

cout<<"Enter number of objects:";

cin>>n;

cout<<"Enter weight value pairs: \n";

item items[n];

for(int i=0;i<n;i++)

cin>>items[i].weight>>items[i].value;

cout<<"\n\nGreedy by Weight\n";

cout<<"=============================\n";

load\_knapsack(max, items, n, "weight");

cout<<"\n\nGreedy by Profit\n";

cout<<"=============================\n";

load\_knapsack(max, items, n, "profit");

cout<<"\n\nGreedy by Density\n";

cout<<"=============================\n";

load\_knapsack(max, items, n, "density");

}